AM MODULATION MONITOR

MODEL 732

TFT

TIME AND FREQUENCY TECHNOLOGY, INC.

760-03

408 - 727 - 7272

AM MODULATION MONITOR

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TIME & FREQUENCY TECHNOLOGY, INC.
3000 Olcott Street
Santa Clara, Ca. 95051
246-6365

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SECTION 1

GENERAL INFORMATION

1.1 General Description.

The Model 732 AM Modulation Monitor is intended for continuous monitoring of an AM transmitter operating in the standard broadcast band (540 to 1600kHz) to enable the station to comply with the requirements of Section 73.60 of the FCC Rules and Regulations. The Monitor, which is factory-adjusted for the customer's assigned transmitter frequency, provides direct peak-reading meter indication of modulation percentage. Other features include - -

- A flasher to indicate 100-percent negative modulation peaks.
- An adjustable flasher to indicate positive or negative modulation peaks.

1.2 Specifications.

RF Input

Frequency range	540 - 1600 kHz
Sensitivity	
Automatic gain control mode, Antenna Input	approx. 1.0mV, with 40 dB automatic gain control range 100 mV maximum.
Manual gain control mode, RF input	approx. 5V to 10V input without external pad.
Selectivity	
±10 kHz	0.25 dB
±11 kHz	-3 dB
±20 kHz	-40 dB
±30 kHz	-60 dB
Input impedance	50 ohms nominal
Input connector	BNC
Image rejection	50 dB or greater

Modulation Meter

Meter range	Switchable, 0 to 133% on positive peaks, 0 to 100% on negative peaks.
Accuracy	±2% at 100% modulation, ±4% at any other % modulation for modulation frequency between 30 Hz and 10 kHz.
Meter characteristics	Peak reading circuit, scale and ballistics conform to FCC requirements.
Remote metering	Output provided for Model 704D.

Peak Modulation Indicators

Variable peak indicator	Level set by front-panel 3-digit thumbwheel switch in 1% steps, 50 to 129% on positive peaks, 50 to 100% on negative peaks.
Fixed peak indicator	99.5% or greater on negative modulation only.
Accuracy	±2%
Response time	200μsec pulse
Remote Indicators	Output provided for Model 704D.

Modulation Calibrator

Built-in modulation calibrator indicates ±100% modulation

Accuracy	±2%

Rear Panel Outputs

Audio	Two volts RMS into 600 ohms at 100% modulation, ±0.5 dB 30 Hz to 10 kHz, less than 1% harmonic distortion.
Broad Band Audio (Output is present only when rear panel Jack, J5 is used)	At 10VRF, 99% modulation: Output is 2 VRMS into 600 ohms, ±0.5 dB 30Hz to 20kHz, signal/noise ratio 75 dB, distortion, 95% modulation, less than 0.25%.
Remote meter and peak flasher . .	For use with Model 704 D remote meter and peak flasher panel.

1.2 (Continued)

Rear Panel Outputs (cont.)

Carrier Alarm (optional)	*floating relay contact closure provided
Absence of Audio Alarm (optional) . . .	
Peak counter	
Telemetry output (optional)	1.5 Vpp at 5% modulation, 600 ohms unbalanced.

*Note: all relay contacts are rated for a maximum load of 500 ma at 50V.

Physical and Environmental Specifications

Power	115/230V, 50-400 Hz, 30 watts max.
Operating Temperature	0° to +50°C
Dimensions	19" W x 7" H x 16" D
Weight	17 pounds
Cabinet	Rack mounting.

1.3 Accessory Equipment

Model 704D Remote Meter and Peak Flasher Panel: Duplicates meter and peak flasher readings of the Model 732.

Model 722 Resonant Loop Antenna: A compact loop antenna for use with Model 732 where field strength is at least 20 mV per meter.

1.4 Warranty

TIME & FREQUENCY TECHNOLOGY, INC., warrants each of the instruments of its manufacture to be produced to meet the specifications delivered to the BUYER; and to be free from defects in material and workmanship and will repair or replace, at its expense, for a period of one year from the date of delivery of equipment, any parts which are defective from faulty material or poor workmanship.

1.4 (Continued)

Instruments found to be defective during the warranty period shall be returned to the factory with transportation charges prepaid by BUYER. It is expressly agreed that replacement and repair shall be the sole remedy of BUYER with respect to any nonconforming equipment and parts thereof and shall be in lieu of any other remedy available by applicable law. All returns to the factory must be authorized by the SELLER, prior to such returns. Upon examination by the factory, if the instrument is found to be defective, the unit will be repaired and returned to the BUYER, with transportation charges prepaid by SELLER.

Transportation charges for instruments found to be defective within the first thirty (30) days of the warranty period will be paid both ways by the SELLER.

Transportation charges for warranty returns, wherein failure is found not to be the fault of the SELLER, shall be paid both ways by the BUYER.

This warranty does not apply to instruments which, in the opinion of the SELLER, have been altered or misused.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. TFT IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

1.5 Claim for Damage in Shipment.

Your instrument should be inspected and tested as soon as it is received. The instrument is insured for safe delivery. If the instrument is damaged in any way or fails to operate properly, file a claim with the carrier, of if insured separately, with the insurance company.

WE SINCERELY PLEDGE OUR IMMEDIATE AND FULLEST COOPERATION TO ALL USERS OF OUR PRECISION ELECTRONIC INSTRUMENTS.

PLEASE ADVISE US IF WE CAN ASSIST YOU IN ANY MANNER

Time & Frequency Technology, Inc.
3000 Olcott St.
Santa Clara, Ca. 95051

408-246-6365

SECTION 2

INSTALLATION

2.1 Unpacking and Inspection.

Upon receiving the instrument, inspect the packing box and instrument for signs of possible shipping damage. Operate the instrument in accordance with the procedures of Section 3 of this manual. If the instrument is damaged or fails to operate properly, file a claim with the transportation company, or with the insurance company if insured separately.

2.2 Power Requirements.

The Model 732 is factory wired to operate from either a 115-volt or a 230-volt AC source. A marking on the rear panel of the instrument indicates which voltage is to be used. The line frequency must be between 50 and 400 hertz. Maximum power required is 30 watts.

2.3 Installation Remote from Transmitter.

When the instrument is installed in the studio, or any place distant from the transmitter, a rooftop antenna must be used. Where a strong signal can be expected (i.e. greater than 40 mV/meter) the Model 722 Resonant Loop Antenna may be used. In lower signal locations a long wire (approximately 200 feet) can be used with good results. When the Model 722 Antenna is used a 50 ohm coax should be used to connect the antenna to the Model 732. When a long wire is used it can be connected at the ANTENNA INPUT of the Model 732, a 51 ohm resistor should also be connected from the input to the chassis ground. The procedure for proper adjustment of the input level is as follows:

a. Depress the PWR ON switch and set the Gain Switch to Automatic on the Model 732 front panel.

b. Connect a DC Voltmeter with at lease 20,000 ohms per volt impedance to pin F of the 9-pin rear-panel connector. This is the I.F. AGC Voltage. For the AGC to be in its operable range this voltage should be less than +5 volts and greater than +2 volts. This range between 2.5 and 2.75 volts is optimum.

c. When the Model 722 Antenna is incorporated, rotate the antenna until a minimum AGC Voltage is read on the DC voltmeter. When a resonant loop antenna is constructed, change the value of "C" until a null is realized. (Fig. 3-2). (Note: the AGC voltage decreases as the RF level into the Model 732 increases.) If the AGC voltage goes below 2.0 volts, too much RF signal is being received and an attenuator pad must be inserted in the RF cable from the antenna.

2.3 (Cont'd)

d. With the AGC voltage in the proper range, adjust the Automatic Gain pot such that the CARRIER LEVEL meter is at the SET position.

In order to observe the changes in carrier intensity during modulation it is necessary to transfer the antenna cable from the ANTENNA INPUT to the RF INPUT on the rear panel, set the front panel GAIN Switch to MANUAL position and adjust the MANUAL gain pot so that the CARRIER LEVEL METER is at SET position. Because of the difference in sensitivity between the two RF signal input jacks, it may be necessary to use a different input attenuator to bring the RF level within the effective range of the monitor.

2.4 Installation at the Transmitter Site

When the Model 732 is installed at the transmitter site, a 50 ohm coaxial cable should be used to bring the RF signal from the transmitter sampling point to the RF INPUT at the rear panel of the monitor.

CAUTION

Always use the factory furnished attenuator when connecting the monitor input to an unknown RF voltage. Remove attenuator if signal level is found to be inadequate to operate the monitor.

Set the GAIN switch on the front panel to MANUAL position and adjust the MANUAL Gain Control pot so that the CARRIER LEVEL METER is at SET position.

SECTION 3

OPERATION

3.1 General.

The Model 732 AM Modulation Monitor displays modulation percentage and provides a flashing indication when the modulation percentage exceeds 99.5 percent on negative peaks and when it exceeds a preset limit on either positive or negative peaks depending on the selection of the front panel switch.

3.2 Front-Panel and Rear-Panel Controls.

The front-panel controls, connectors, and indicators of the Model 732 are described in Table 3-1 and illustrated in Figure 3-1. Rear-panel controls and connectors are described in Table 3-2 and illustrated in Figure 3-1. Page 3-6.

3.3 Turn-On and Warm-up.

Check the marking on the rear panel to make sure the instrument is wired for the line voltage to be used (115 volts or 230 volts). Plug the line cord into the power source. Energize the instrument by depressing the PWR ON switch. If the monitor is at the transmitter site, connect the rear-panel RF INPUT connector to the transmitter RF coupler, as described in Section 2.4, and adjust the input level as described in that section.

If the Monitor is used at the remote control location, refer to Section 2.3 of this manual for proper adjustment.

3.4 Measurement of Amplitude Modulation Using Modulation Meter.

The modulation meter is used by simply pushing either the "+" or "-" switch on the front panel. The meter gives a quasi-peak indication of either "+" or "-" peak modulation depending upon front-panel selection. For maximum accuracy the modulation meter calibration should be checked regularly and adjusted if necessary. Calibration of the meter is performed by depressing the CAL button and adjusting the METER CAL control until the meter reads exactly 100 percent.

3.5 Peak Flasher Operation.

The peak flasher is intended to catch fast transients and peaks that the meter cannot respond to. The peak flasher is operated by depressing either the "+" or "-" switch and setting the thumbwheel switches to the desired percentage of modulation. If the modulation then exceeds that number in the direction selected, the flasher lamp will go on, and stay on for approximately 2 seconds. The peak flasher accuracy should also be checked regularly and adjusted if necessary.

3.5 (Continued)

Peak flasher calibration is achieved by depressing the CAL button, setting the thumbwheel switches for 100 percent, and adjusting the FLASHER CAL control until the peak flasher lamp just comes on.

3.6 Use of the Model 704D Remote Meter and Peak Flasher Panel.

This panel duplicates the indications of the front-panel MODULATION meter and the variable and -100% peak flasher lamps. The 50-foot cable from the Model 704D connects to the rear panel of the Model 732.

3.7 Audio Output

An audio output is available at the AUDIO connector on the rear panel. Its level is approximately 4 volts RMS into an open circuit, and it can be fed into a distortion analyzer to measure system distortion. It can also be used to operate high-impedance earphones if desired. (600Ω output impedance)

3.8 Subaudible Telemetry (Optional).

When this option is incorporated, subaudible telemetry modulation on the carrier is delivered to the rear-panel TELEMETRY OUTPUT connector through a low-pass filter and amplifier.

3.9 10kHz Whistle Filter (Optional)

This Hi-"Q" notch filter can be inserted in the audio output to eliminate interference from an adjacent channel. This does not apply to the Modulation meter or peak flasher circuits, only the audio output.

3.10 Absence of Modulation Alarm (Optional)

This circuit closes a set of relay contacts when the recovered modulation drops below 10% for a fixed period of time. This fixed delay time is internally adjustable from two to sixty seconds.

3.11 Carrier Power Alarm (Optional)

This circuit closes a set of relay contacts when the carrier level exceeds pre-set limits. In the Manual gain mode the carrier level limits are set to +5% and -10% of nominal. In the automatic gain mode the carrier alarm can only detect the total loss of carrier signal.

3.12 Peak Modulation Indicator.

The Model 732 contains a relay which is energized when the peak modulation exceeds the limit set on the front-panel thumbwheel switch. The normally open relay contacts close to short the rear-panel outputs together. The contacts are floating with respect to the chassis and therefore can be hooked up in many different ways to ring an alarm or trigger an event counter.

3.13 Carrier Frequency Output (Option)

With the Carrier Frequency Output Option installed, a signal representing the frequency of the monitored carrier is available at the Carrier Frequency Output jack on the front panel of the 732. This option is designed to provide 150 m.v.r.m.s. into the 50 ohm (nominal) input of an external frequency counter.

Table 3-1. Front-Panel Controls and Indicators

Fig. 3-1 Ref. No.	Name	Function
1	"Manual/Automatic Gain" Switch and Controls	When the switch is in the "Manual" position the "manual" knob should be adjusted so that the "Carrier Level" meter is at the Set position. Any change in input level will show up a shift on the "Carrier Level" meter, and will require a re-adjustment of the manual gain control for the Modulation indicators to be calibrated. When the switch is in the "Automatic" position the "automatic" knob should be adjusted so that the "Carrier Level" meter is on the "Set" mark. The instrument will now automatically compensate for changes in input level.
2	"Power" Switch	This switch applies 115/230 VAC to the power transformer primary when depressed.
3	"+" and "-" Switches	These switches allow the modulation meter, and the "+/-" peak indicator to be switched between plus and minus modulation peaks.
4	"Cal" Switch, "Meter Cal" pot and "Peak Flasher Cal" pot.	When this switch is depressed the Carrier modulation is replaced by a very amplitude stable internal oscillator to calibrate the "Modulation" meter and the "+/-" peak flasher at 100%.
5	"+/-" peak Modulation indicator, and Thumbwheel Switches.	This indicator flashes when modulation exceeding the amount set on the thumbwheel switches is present. The indicator will signal + or - modulation peaks, depending upon the + and - switch settings as indicated in Section 3 above.

Table 3-1. (Continued)

Fig. 3-1 Ref. No	Name	Function
6	-100% Peak indicator	This indicator flashes when modulation peak exceeds-99%.
7	Modulation meter	Reads carrier modulation directly in percentage. The Modulation being monitored positive or negative, depends on the setting of the "+" and "-" switch. (See Section 3 above).
8	"Carrier Level" meter	In conjunction with the gain controls, (See Section 1 above is used to set the proper carrier level for the modulation indicators to be calibrated.
9	Carrier Frequency	High level carrier output, to be monitored with counter.

Table 3-2. Rear-Panel Connectors and Controls

Fig. 3-2 Ref. No.	Name	Function
1	RF INPUT (Automatic Gain Only)	Provides a means of connecting a 50-ohm cable from a rooftop antenna, or from the transmitter RF coupler through a 40-dB pad at the transmitter site. Maximum input at this connector is 100 mV. The input gain is controlled automatically after the level is set by the Automatic gain control pot.
2	A-Remote Meter	The same voltage that drives the front-panel modulation meter is used to drive the remote modulation meter Model 704D.
3	C-"+" Peak	Closes a circuit to ground to operate the "+" Peak Lamp on the remote panel Model 704D.
4	E-"-" Peak	Closes a circuit to ground to operate the "-100% Peak" Lamp on the remote panel Model 704D.

Table 3-1. (Continued)

Fig. 3-2 Ref. No.	Name	Function
5	F - AGC	AGC Voltage, should be measured with a 20,000-ohm-per-volt meter. Decreases with increasing Carrier level.
6	Whistle Filter	(Optional) When switched to the IN position a 10 kHz notch filter is inserted in series with the audio output.
7	Audio	Recovered carrier Modulation, 2V RMS into 600 ohms for 100% modulation.
8	Telemetry Output	(Optional) Supplies subaudible telemetry information contained on the carrier.
9	Peak Counter	Provides closure on floating relay contacts when the front panel peak lamp is activated.
10	Absence of Audio Alarm	(Optional) Provides closure on floating relay contacts when audio modulation drops below 10% for longer than the delay internally set.
11	Carrier Alarm	(Optional) Provides closure of floating relay contacts when limits of +5% or -10% are exceeded in the manual gain mode, or the carrier drops below the minimum sensitivity in the automatic gain mode.
12	RF INPUT (Manual Gain Mode Only)	When the instrument is used in the Manual gain mode the transmitter sampling point may be directly connected to this input. Maximum input at this connector is 2.25 V. This input also provides the means of observing the carrier intensity shift due to modulation.
13	Broad Band Audio	Provides the audio signal obtained by demodulating the transmitter carrier. Level is 2 volts RMS into, 600 ohms at 100% Modulation. Response is within ±0.5 dB from 30 Hz to 20 kHz.

REVISIONS		
LTR	Description	Date
A	RELEASED TO PRODUCTION	9-7-73
B	REVISED PER ECO # 136	4-10-74

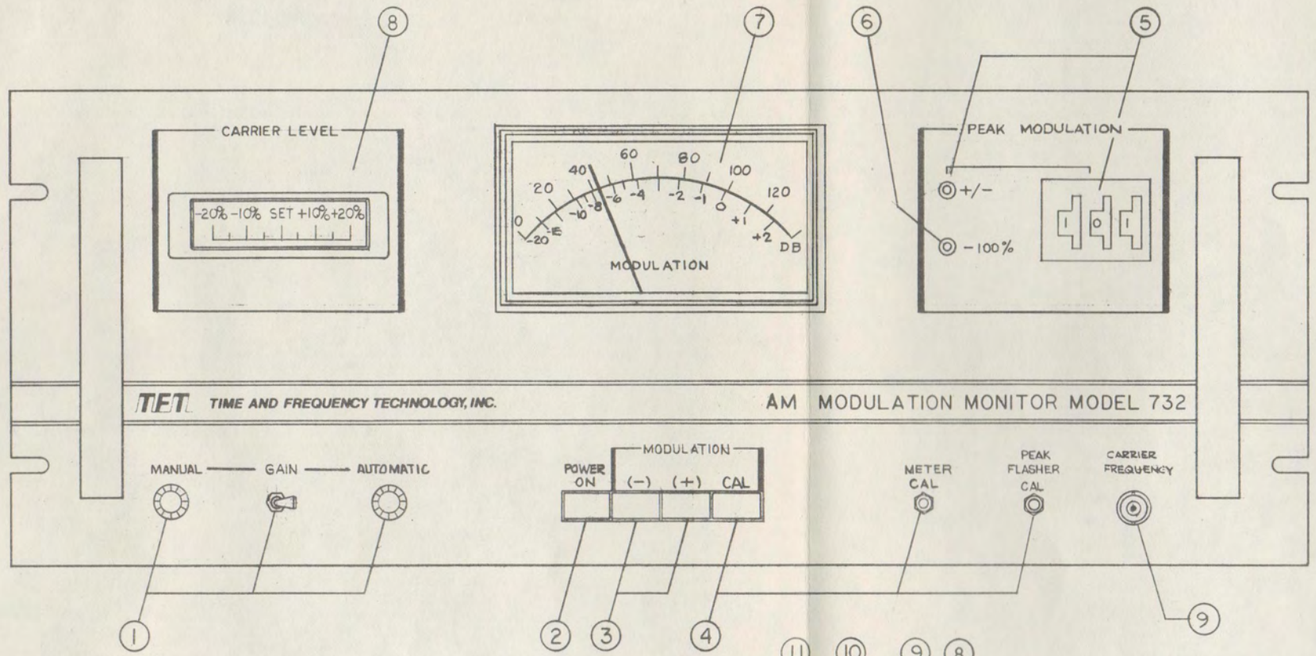


FIGURE 3-1

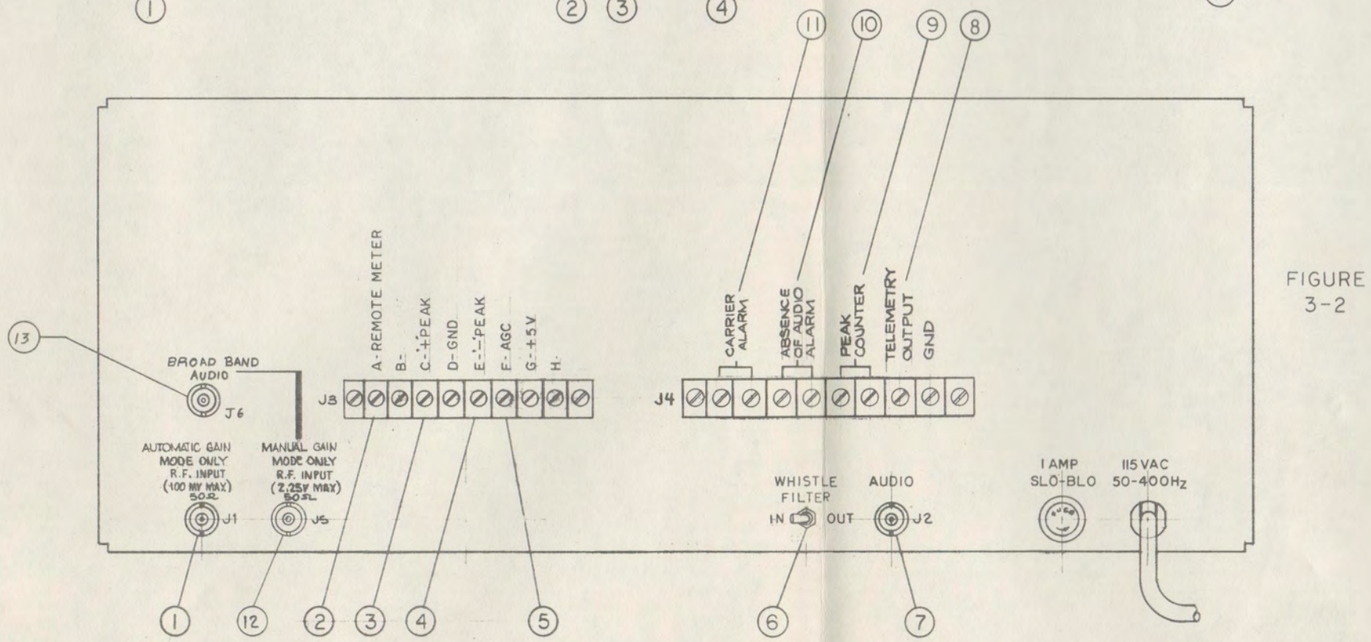
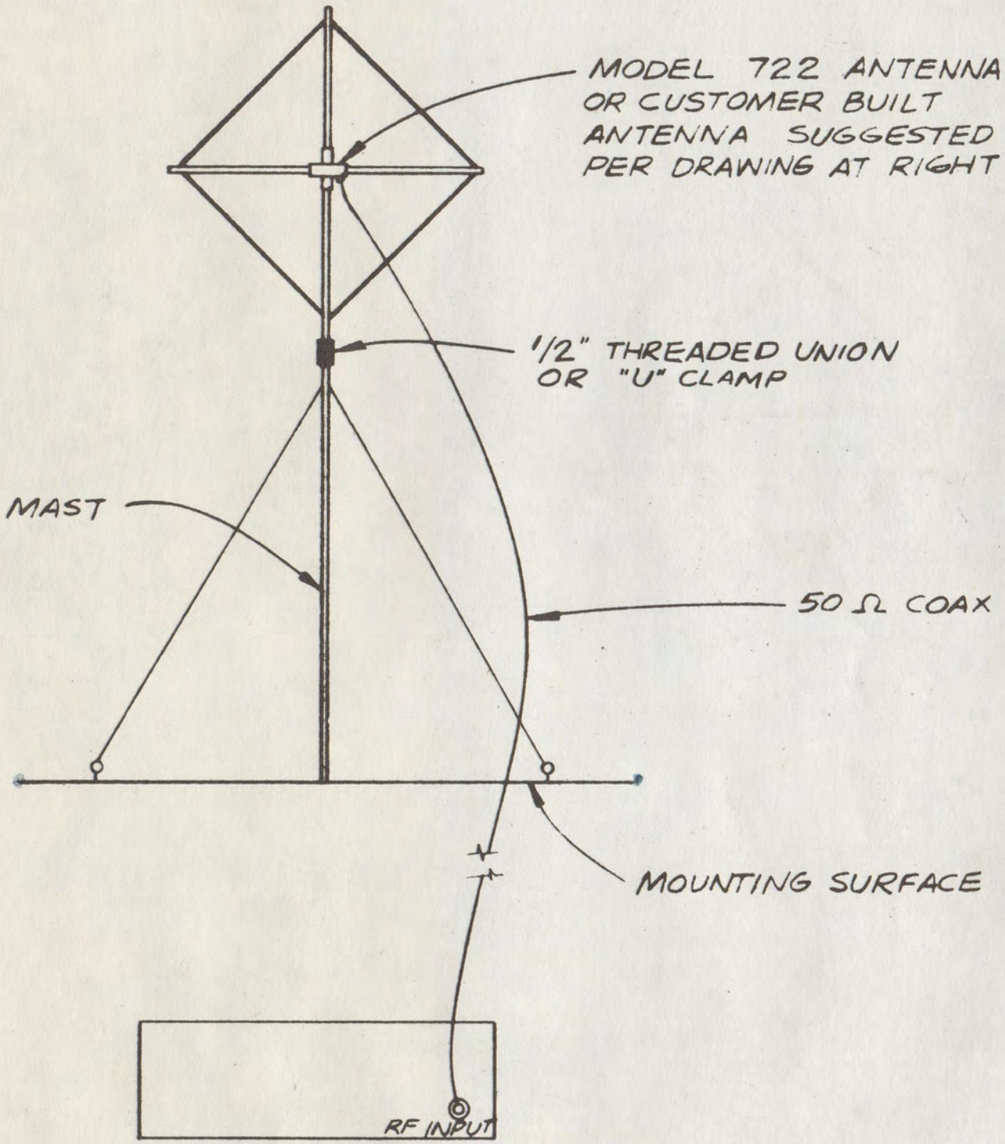


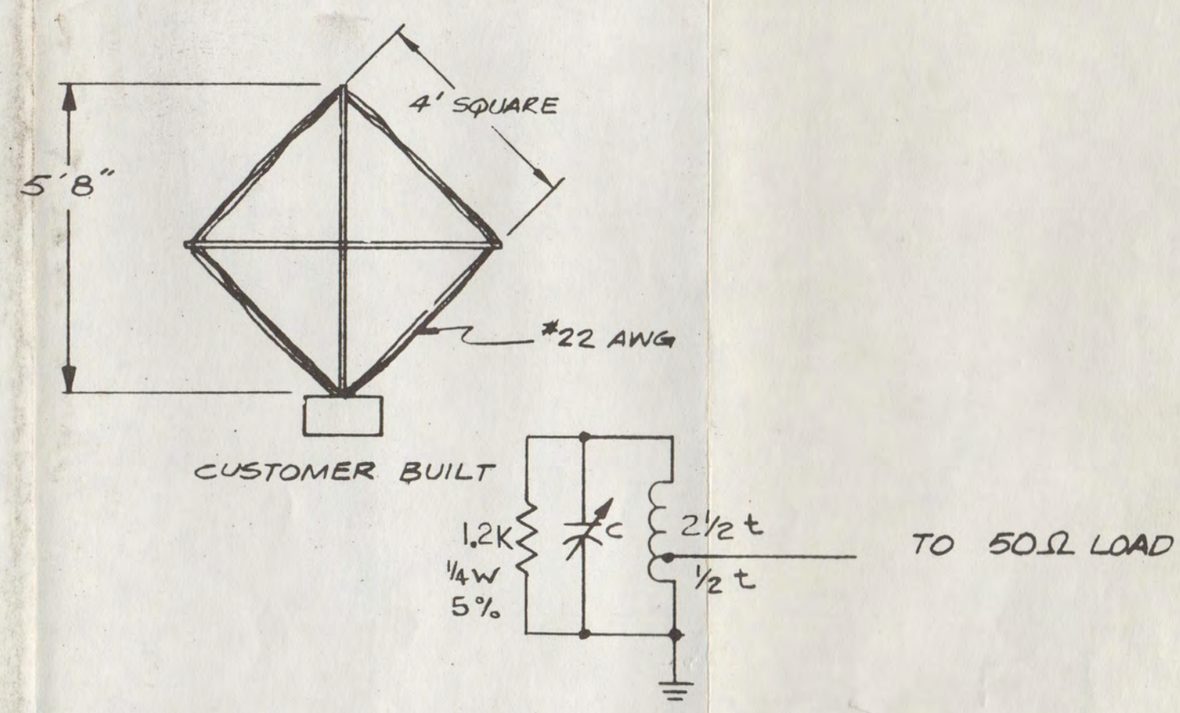
FIGURE 3-2

TET TIME AND FREQUENCY TECHNOLOGY, INC.		
SCALE 1/1	APPROVED BY	DRAWN BY D.S.
DATE 11-13-72		REVISED 5-17-73
PANEL - FRONT & REAR		
MODEL 732		DRAWING NUMBER 6600-026

REVISIONS		
LTR	Description	Date



MODEL 732
REAR PANEL



TUNE C SO THAT ANTENNA
RESONATES AT DESIRED FREQ

1600 KHZ C ≈ 30 pf
540 KHZ C ≈ 600 pf

MODEL 732

SCALE:	APPROVED BY:	DRAWN BY
DATE:		REVISED

SUGGESTED ANTENNA SET-UP

FIG. 3-3

DRAWING NUMBER 6600-0420

SECTION 4

THEORY OF OPERATION

4.1 General.

The Model 732 AM Modulation Monitor is a single-conversion superheterodyne receiver. The Model 732 makes high-accuracy measurements of the percentage modulation of an AM broadcast signal.

Figure 6-1 is a block diagram of the Model 732. The RF signal to be monitored is brought in through the RF INPUT connector and applied through an RF filter to one input of the gain controlled mixer. The RF filter is factory selected to pass the frequency of the carrier to be monitored. The gain controlled mixer converts the carrier down to 450 kHz, the amplitude of the 450 kHz product can be controlled by the AGC circuit as described in a later paragraph.

The Local-oscillator (L.O.) input to the mixer comes from Board A4, the power supply and L.O.Board. The L.O. signal is generated by a crystal controlled oscillator. The oscillator frequency is set to 450 kHz above the assigned carrier frequency.

The 450 kHz output of the mixer is passed through two I.F. filters and amplified. These two filters give the Model 732 its excellent rejection to close channels. The Amplified 450 kHz is then processed by the audio detector circuits.

The audio output from the audio detector is fed through an amplifier to the modulation measurement circuits on the A2 Board. When the amplitude of the negative half cycles of the audio signal corresponds to -99-percent modulation of the transmitter carrier, the output of the -100% peak detector triggers a one-shot multivibrator, which turns on the -100% PEAK light-emitting diode (LED) to cause it to flash, indicating that the transmitter carrier has been modulated to 100 percent in a negative direction.

The output of the audio amplifier is also fed through two unity-gain amplifiers, one inverting and one noninverting. The noninverting amplifier output is selected by the METER (+) switch, and the inverting amplifier output by the METER (-) switch. The selected output is fed through the meter calibration potentiometer and an amplifier to the MODULATION meter. The same selected output is also fed through the flasher calibration potentiometer to the programmable peak detector. This peak detector is referenced to a voltage selected by a front panel thumbwheel switch. When the peak detector input voltage exceeds the reference DC voltage, it triggers a one-shot multivibrator which produces a pulse to light the PEAK LED for approximately 2 seconds.

To calibrate the MODULATION meter and PEAK lamp, the METER CAL switch is depressed, causing a stable 1-kHz sine wave source to be substituted

4.1 (Continued)

for the detected audio signal. The amplitude of the 1-kHz sine wave corresponds to 100-percent modulation of the monitored carrier when the carrier level is adjusted to its calibrated value as indicated by the CARRIER LEVEL meter. The METER CAL potentiometer is then adjusted so that the MODULATION meter reads 100 percent, and the FLASH CAL potentiometer is adjusted so that the PEAK lamp flashes with the front-panel PEAK MODULATION thumbwheels set for 100 percent.

4.2 Detailed Circuit Description.

4.2.1 Power Supply and L.O. Board (A4).

(Circuit Diagram: Figure 6-7)

This board contains the rectifiers and regulators for ±15V and +5V power supplies, as well as the Crystal Controlled Local Oscillator, and the calibration oscillator.

The three power supplies each consist of a diode bridge rectifier, followed by a filter capacitor, and an I.C. voltage regulator. The voltage regulators are fully self-protecting, and not adjustable. Z1 is the regulator for the +15V supply, Z2 the -15V supply, and Z4 the +5V supply.

Z3, Y1 and associated components make up the Crystal Controlled Local Oscillator. The crystal (Y1) frequency is selected to be 450 kHz above the customer assigned frequency. Z3 is a differential pair with current source. The current source is used with Y1 as an oscillator, and 1/2 of the differential pair is used as a common base amplifier. The L.O. output at pin 6 of Z3 is fed to the gain controlled mixer on A1.

The Calibration Oscillator consists of Q1, Q2, Q3, Z5, Z6, and associated components. Q1 and Q2 form a stable multivibrator that runs at a 1kHz rate. Q3 acts as a buffer stage, and Z5 with its associated components is an active lowpass filter. The output at pin 6 of Z5 is a 1kHz sinewave. The pot R15 at the ouput of Z5 is set to give the correct amplitude to simulate a 100% audio signal. Z6 sums a D.C. Voltage with the 1kHz signal to simulate the correct carrier level. The output of Z6 is a 1kHz signal "riding" on a D.C. Voltage. This corresponds exactly to a 100% modulation signal when the carrier level is adjusted to the "SET" mark.

4.2.2 IF Board (A1).

(Circuit Diagram: Figure 6-4)

The signal to be monitored, at pin 4 of P1, is applied through an RF filter to one input of integrated circuit mixer Z1. The filter, which consists of all the components shown on the schematic diagram between pin 4 of P1 and the attenuator, provides 50 dB of image rejection.

4.2.2 (Continued)

The filter components are factory selected to provide a 3-dB bandwidth of 90kHz, centered on the frequency to be monitored. The second input to mixer Z1 is the LO signal from Board A4, brought into Board A1 through pin 2 of P1. The mixer output, at pin 9 of Z1, is fed through jumpered test points TP-1 and TP-2 to the input of the first IF filter. Potentiometers R18 and R22 adjust the filter input and output resistances respectively for proper matching. Buffer Q3 provides isolation between the first and second IF filters, and R43 and R39 adjust input and output resistances of the second filter.

The gain of the IF strip is controlled by varying the gain at the IC mixer Z1. This is accomplished using an optically coupled isolator consisting of a photosensitive resistor and Light Emitting Diode (LED) packaged together. As the current through the LED varies, it changes the resistance of the photoresistor. The resistance increases as the current through the diode decreases. The LED is driven from the AGC circuits.

The audio detector is an active rectifier consisting of Z2, CR2, CR3 and associated components. The resulting waveform at TP-6 contains the positive half cycles of the 450kHz signal, bounded by the modulation envelope. This signal is applied through an active low-pass filter (Z3) with a cutoff of approximately 25kHz to differential amplifier Z4 in the AGC amplifier circuit; to amplifier Z8 in the meter amplifier circuit; and to audio amplifier Z5. The output of the low-pass filter contains the Audio Information and Carrier Level Information.

The Model 732 gain can be controlled manually or by the internal automatic gain control circuitry, by use of the front-panel gain switch and the manual or automatic gain pots. When the switch is in the manual mode the I. F. gain is switched to approximately 100 mV sensitivity, and the input RF is controlled by the manual gain pot. The RF input is attentuated before it reaches the I. F. strip so that in the manual mode the sensitivity of the instrument varies from 0.5 V RMS to 2.25 V RMS depending upon the setting of the manual gain pot. When the Model 732 is used in the automatic gain mode, the RF signal is fed directly to the RF filter on the I. F. Board, where it is mixed with the L.O. to produce the 450kHz I. F. signal. The sensitivity of the Model 732 in the automatic mode varies from 1 mV RMS to 100 mV RMS, automatically holding the Carrier level meter to the point set by the automatic gain pot. Normally this is on the "SET" mark.

When the Model 732 is operated in the automatic gain control mode the wiper of the front-panel 100 ohm CARRIER LEVEL pot supplies a reference voltage to the noninverting input of Z4, with the rectified I. F. signal from Z3 being applied to the inverting input of Z4. If the carrier level increases, the rectified I. F. level increases, causing the output of Z4 to decrease and increasing the resistance of the optically coupled isolator which reduces the I. F. level to its proper value. A decrease in the carrier power has just the opposite effect. The AGC amplifier has a high frequency cutoff at about 5Hz so that it responds only to the average value of the rectified I. F. signal and not to the modulation. Zener diode CR1 in the base circuit of Q6 limits the current through the LED to a safe value. Note the AGC voltage at the output Z4 and at pin D of the rear panel connector (J3) decreases with increasing carrier level.

4.2.2 (Continued)

The meter amplifier consists of differential amplifier Z8 and current drive Z7. Current through the CARRIER LEVEL meter varies with the average value of the rectified IF applied to pin 2 of Z8. The reference voltage at pin 3 of Z8 is factory set by potentiometer R70 so that an IF level of 400 millivolts at the output of buffer amplifier Q5 (TP-5 and TP-9) will cause the CARRIER LEVEL meter to indicate midscale (SET position).

The audio amplifier consists of integrated-circuit amplifier Z5 with a gain of 5 and integrated-circuit amplifier Z6 with a gain of 2.5. Two audio outputs are provided, one at pin 5 of J1 for the rear-panel AUDIO jack and the other at pin 8 at J1 for the rear-panel TELEMETRY OUTPUT jack.

4.2.3 Peak Flasher and Meter Amplifier (A2).

(Circuit Diagram: Figure 6-5)

This board drives the modulation meter, the peak modulation lamps, and the peak counter relay from the audio signal on Board A1. The audio signal is brought into Board A2 at pin 2 of the board connector. When the front-panel METER CAL switch is depressed, this audio input is a sine wave from Board A4 with a negative peak of 0 VDC and a positive peak of approximately +4.5 VDC which corresponds to 100-percent modulation of the monitored carrier. The audio input is applied to the inverting input of threshold detector Z1, which acts as a comparator. The other input to the comparator is a DC voltage, very nearly 0 VDC, factory-set by potentiometer R3 to give a positive pulse out of Z1 when the negative peaks of the audio input just reach 0 VDC. When the front-panel METER "+" or "-" switch is depressed, thus releasing the METER CAL switch, any audio input from Board A1 at pin 2 of the Board A2 connector whose negative peaks reach zero or a negative value will produce a positive pulse at the output of Z1. This positive pulse triggers the one-shot multivibrator Z2, R4 and C7 producing a positive pulse approximately 2 seconds in duration at pin 2 of Z2. This 2-second pulse is inverted by Z3 and applied to driver Z4 which turns on the -100% PEAK LED for the duration of the pulse out of the one-shot multivibrator. This same output is also fed to pin E of rear-panel connector J3 to operate a remote negative-peak lamp.

The audio input at pin 2 of the board connector is also applied to inverting unity-gain amplifier Z5 and noninverting unity-gain amplifier Z6. The outputs from these two amplifiers are fed to the front-panel METER "-" and METER "+" switches so that either the negative or positive peaks can be measured. The selected output is applied to front-panel METER CAL potentiometer R2 and front-panel FLASH CAL potentiometer R1 (see Figures 6-1 and 6-2).

The selected (positive or negative peak) audio signal at the wiper of R2 on the front panel enters Board A2 at pin 18 of the board connector, and is applied through emitter follower Q1 and amplifier Z9 to the audio rectifier consisting of CR2 and associated components. The DC voltage at the cathode of CR2, whose

4.2.3 (Continued)

value is proportional to the peak modulation amplitude, is fed through current driver Z10 to the front-panel MODULATION meter and to rear-panel connector J3-A to drive a remote meter.

The selected (negative or positive) audio signal at the wiper of R1 of front panel enters Board A2 at pin 8, and is applied to the noninverting input of the comparator Z7. The inverting input to Z7 is from constant-current source Z8. The voltage output of Z8 applied to the inverting input of Z7 is controlled by the resistance selected by the front-panel thumbwheel switches SW8 and SW9. Thus, when the audio input at pin 8 of the board connector exceeds the voltage at pin 4 of Z7, a positive pulse is produced at pin 9 of Z7. This pulse is stretched by one-shot multivibrator Z2 to approximately 2 seconds and this 2-second pulse is applied through inverter Z3 and driver Z4 to the front-panel PEAK LED CR1 and to Board A3 to energize a relay and also to drive a remote peak indicator.

4.2.4 Telemetry Output Board (A3)

(Circuit Diagram: Figure 6-6)

4.2.4.1 Telemetry Output Board

This board contains the circuitry for the remote peak counter and is standard equipment. The board also contains the telemetry circuitry, the carrier alarm circuitry, 10kHz Whistle Filter and the Loss of Modulation Alarm when these options are selected.

The peak counter circuit consists of relay K1 and associated components. The relay is energized when the output of driver Z4 on A2 board goes low, as described in Section 4.2.5. When relay K1 energizes, it supplies a contact closure to rear-panel connectors J4 and J5.

4.2.4.2 Telemetry Lowpass (Optional)

The telemetry circuit is simply a low-pass active filter consisting of Z5, Z6 and associated components. This filter has an upper cut-off of approximately 35 Hz to pass only subaudio telemetry signals.

4.2.4.3 Carrier Power Alarm (Optional)

The carrier alarm consists of Z1, Z2, Q1, K2 and associated components. Input is from the carrier level meter circuit on Board A1 through pin 9 of the A5 board connector. Integrated circuits Z1 and Z2 are comparators. When the Model 732 is located at the transmitter being monitored, potentiometers R9 and R6 can be adjusted to cause K2 to energize when the carrier level goes 5 percent above or 10 percent below nominal. During this mode of operation, the gain must be controlled manually as described in Section 4.2.2. For remote operation and automatic gain control of the Model 732, the alarm circuitry can only be used to energize K2 when the carrier goes completely off. The contacts of K2 provide a short between rear-panel connector J4-1, and J4-2 when relay K2 is energized.

4.2.4.4 Loss of Modulation Alarm (Optional)

The modulation alarm consists of Q2, Q3, Z7, Q4, and their associated components on the A3 Board. The input to this circuit comes from the modulation meter circuit on the A2 Board. This circuit looks at the A.C. signal driving the meter detector, on the A2 Board, Q2 amplifies this A.C. signal such that it will keep Q3 turned ON when modulation greater than 10% is present. When the modulation drops below 10%, Q3 is shut off and C22 charges through R38. When the voltage on C22 reaches the threshold set by the pot R40, the output of Z7 goes high and turns ON Q4, closing the K3 relay contacts. By varying the setting of R40, the delay between loss of modulation, and closing the relay contact, can be varied; from a minimum of two seconds to a maximum of 60 seconds.

4.2.4.5 10kHz Whistle Filter (Optional)

The 10kHz filter is an active High "Q" twin-tee notch filter consisting of Z3, Z4, and their associated components on the A3 Board. The capacitors C9-C17 along with R26, R27, and R28 form a twin-tee notch circuit. Op-Amps Z3 and Z4 provide feedback to increase the "Q" of the notch, and the output to the rear panel Whistle Filter Switch. This circuit is only affecting the rear panel audio output, and not the modulation meter or peak flasher circuits.

4.2.4.6 Carrier Frequency Output (Optional) (A5)

The L.O. and I.F. signals are mixed in the Double-Balanced Mixer, I.C., Z1. The difference of the two frequencies, the carrier frequency, is selected by the factory-tuned, high-Q circuit of L_3 and C_1. The emitter-follower, Q_1, drives the low-impedance input of an external frequency counter.

SECTION 5

MAINTENANCE

5.1 General.

Since the Model 732 is a solid-state instrument and its power requirements are low, no maintenance problems due to high temperature should be encountered, provided the instrument is installed well away from vacuum-tube and other heat-generating equipment. Likewise, because the operating voltages are low, excessive dust accumulation associated with high-voltage devices should not occur.

5.2 Access.

To gain access to the top-of-chassis components (all printed-circuit boards) remove six screws from the top cover, three on each side, and then remove the top cover. Removing six similar screws from the bottom cover provides access to the below-chassis components (connectors, power transformer and switches).

5.3 Periodic Maintenance.

The only periodic maintenance that should be required is an annual inspection and cleaning. The printed circuit boards should be removed and blown off with compressed air to remove any dust accumulation. In dusty environments more frequent cleaning may be necessary. The chassis should also be blown out with compressed air.

5.4 Calibration of Modulation Meter.

A. Front Panel Calibration

1. Depress the front-panel METER CAL switch. The modulation meter should read 100%. If it does not, adjust the front-panel METER CAL potentiometer. If there is reason to believe that the modulation calibrator is not accurate, a procedure is outlined in Paragraph B below for adjusting the modulation calibrator. Section 5.6 outlines a procedure for calibrating the carrier level meter. This should be done before attempting to adjust the modulation calibrator.

5.4 (Cont'd)

2. To check balance, hold the METER CAL switch down while pressing the METER (-) switch. The meter should read the same as above within 2%. If the meter balance is bad using the internal calibrator either the calibrator circuit, or one of the audio amplifiers is failing, and the factory should be consulted for return and repair.

B. Adjustment of the modulation calibrator

1. Test equipment required for this adjustment are:

(a) Low distortion AM modulator, or signal generator capable of being AM modulated such as Wavetek model #136 Generator.

(b) Oscilloscope with 10 MHz or greater bandwidth, such as Hewlett Packard Model #180 A.

(c) Audio generator such as Hewlett Packard Model #204.

2. Test equipment set-up.

(a) Connect the output of the Wavetek generator to the input of the Model 732 and also to the input of the scope.

(b) AM modulate the R.F. signal using the H.P. 204 audio generator. Set the audio generator for 1KHz and adjust the amplitude such that 100% modulation of the R.F. signal is seen on the scope. 100% modulation should be determined by looking at the point of negative modulation peaks, and increasing the scope vertical sensitivity. The accuracy of this measurement will determine the accuracy of the monitor, so great care should be taken to make correct adjustments. -100% modulation is defined as the point at which the R.F. signal is just cutoff by the modulating signal. Correct -100% modulation is shown in Figure #1.

(c) Depress "-" modulation button on the model 732 front panel, and observe the reading on modulation meter. The meter should read 100% if everything is calibrated correctly. Depress the "+" modulation button on the 732 front panel and again observe the modulation meter reading. It may or may not read 100% depending upon the modulator distortion. If the "+" reading is greater than 101% or less than 99% the -100% reading should be compensated by averaging the "+" and "-" readings.

5.4 (Cont'd)

If the difference between the "+" and "-" readings is greater than 3% an effort should be made to lower the modulator distortion or find a better generator, as more than 3% difference makes it difficult to accurately calibrate the model 732.

(d) Again with the "-" modulation button depressed and making any corrections necessary for differences between the "+" and "-" modulation readings, adjust (if necessary) the "Meter Cal" pot on the front panel for a 100% reading. Depress the front panel "Cal" button and observe the modulation meter reading, it should be 100%. If the internal calibration signal is in error, adjust R15 on the Power Supply and L.O. Board (A4) for a correct (100%) reading.

NOTE: ANY TIME AN ADJUSTMENT IS MADE TO R15 ON THE A4 BOARD, THE PEAK FLASHER CALIBRATION MUST ALSO BE CHECKED!

5.5 Calibration of the Rear Flasher.

A. The -100% flasher.

1. Depress the "METER CAL" button and observe the -100% peak flasher, it should be "ON", or flashing "ON and OFF". If it does not the procedure in the following paragraph can be used to make the necessary adjustments.

2. With the same equipment and set-up used to check the modulation meter calibration in Section 5.4.B the -100% lamp should come ON with -100% modulation. Reducing the modulation to -99% as read on the modulation meter, the -100% lamp should still be ON. Again reducing the modulation to -98%, the -100% lamp should be OFF. Adjusting R3 on the peak flasher and meter amp board (A2) will correct any errors in -100% peak lamp setting.

B. The switchable peak flasher.

1. Again with the AM generator set up for -100% modulation, depress the "-" modulation button on Model 732 front panel, and set the thumbwheel switches for 100%. The peak lamp should be ON, or flashing ON and OFF. Moving the thumbwheel switch setting to 101%, the peak flasher should go out. If necessary, adjust the front panel "Flasher CAL" pot until these conditions are met.

2. Depress the "meter CAL" pushbutton and observe the peak flasher. It should be ON, or flashing ON and OFF with a thumbusheel switch setting of 100%, and

5.5 (Cont'd)

by OFF with a switch setting of 101%. If necessary, adjust R16, on the A4 board to meet these conditions.

5.6 CARRIER LEVEL Meter Calibration Check.

With the top cover of the instrument removed, connect a precision AC voltmeter (HA 3469A digital voltmeter or equivalent) to test point TP5 on IF Board A1. With a signal input to the monitor that is of the correct frequency and of sufficient amplitude to cause the CARRIER LEVEL meter to read to the SET position, the voltage at TP5 should be 400 mV RMS±4 mV. If it is not, calibrate the meter as follows:

a. Rotate the front-panel CARRIER LEVEL potentiometer counterclockwise until the AC voltmeter reads 320 mV. (NOTE: gain control should be in the AGC mode).

b. Adjust potentiometer R70 on the A1 board so that the CARRIER LEVEL meter reads -20%.

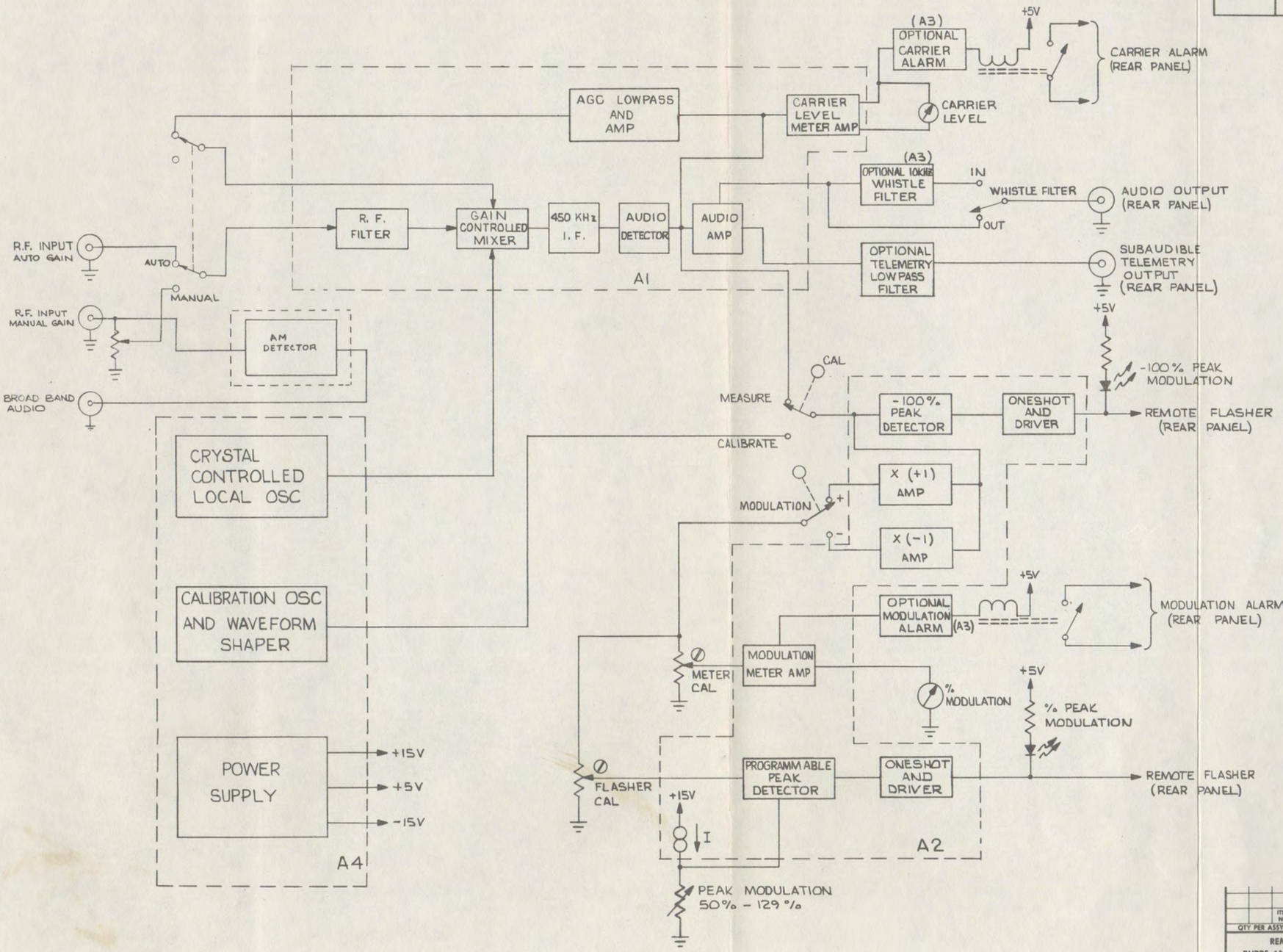
c. Rotate the CARRIER LEVEL potentiometer clockwise until the AC voltmeter reads 480 mV.

d. Adjust potentiometer R66 on the A1 board so that the meter reads +20%.

e. Rotate the CARRIER LEVEL potentiometer counterclockwise again until the voltmeter reads 400 mV. The CARRIER LEVEL meter should now read exactly on SET.

SCHEMATIC DIAGRAMS

NEXT ASSY	USED ON	REVISIONS					
	732	SYM	DESCRIPTION	DR	CHK	AUTH	DATE
		B	REVISED PER ECO # 136	RM			4-8-74



ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.	QTY PER ASSY

LIST OF MATERIALS

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
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.xxx ±
ANGULAR ±

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3000 Olcott St., Santa Clara, California 95050
(408) 246-6365

TITLE: MODEL 732, BLOCK DIAGRAM FIG 6-1

SIZE D | DRAWING NO. 6600-0470 | REV. B

SCALE | SHT | OF

DWG. NO. 6600-0470

FINAL ASSEMBLY, CHASSIS MODEL 732, 5102-0390

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	Chassis, Assembly	5102-0540	
	Front Panel Assembly	5102-0370	
	Handle	2160-0001	Vemaline
	Rear Panel Assembly	5102-0380	
A1	PC Board, I.F.	6608-0201	
A2	PC Board, Peak Flasher	6608-0151	
A3	PC Board, Telemetry	6608-0220	
A4	PC Board, Power Supply & L.O.	6608-0510	
A5	Carrier Frequency (Option)	6608-0671	
	Cover Instrument	2001-0022	
R1	Resistor, 10K, 1/4W, 5%	1065-1002	Allen Bradley
T1	Transformer, Power	1500-0002	
TB1	Terminal Strip, 7-Pin	1700-0007	H. H. Smith
TB2	Terminal Strip, 7-Pin	1700-0007	
	Connector, 22-Pin	2250-1022	Viking

FRONT PANEL ASSEMBLY, MODEL 732, 5102-0370

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	Front Panel	2000-0200	
CR1	L.E.D. & Clip Housing	1285-4403	Hewlett Packard
CR2	L.E.D. & Clip Housing	1285-4403	Hewlett Packard
M1	Meter, Carrier Level	1400-0500	API
M2	Meter, Modulation	1400-7045	Beede
SW 5 & 6	Thumbwheel Switch Assembly	5102-0530	
R1	Potentiometer, 1K, (Peak Cal)	1071-1001	CTS
R2	Potentiometer, 1K, (Meter Cal.)	1071-1001	CTS
R3	Potentiometer, Manual, 100ohm ±20%, 10-turn	1069-9607	CTS
R4	Potentiometer, Automatic, 100ohm ±20%, 10-turn	1069-9607	CTS
SW 1 thru 4	Switch, 4 Gang Push button	1850-0040	IEE
J1	Connector, BNC	2200-7935	Kings
	Lug, GND	1710-1014	
	Terminal Post	1700-1001	
SW7	Switch, Manual-Automatic Gain, 3-P.D.T.	1800-7301	C & K
	Knob, 5/8 O.D. x 1/4 Shaft Dia.	2370-1745	Kurz-Kasch
R21	Resistor, 82 ohm, 1/4W, 5%	1065-0082	Allen Bradley
R22	Resistor, 100 ohm, 1/4W, 5%	1065-0100	Allen Bradley
R23	Resistor, 18 ohm, 1/4W, 5%	1065-0018	Allen Bradley
R24	Resistor, 100 ohm, 1/4W, 5%	1065-0100	Allen Bradley

THUMBWHEEL SWITCH ASSEMBLY, MODEL 732, 5102-0530

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	Thumbwheel Switch	1875-0111	Interswitch
	Resistor, Metalfilm 40 ohm 1/8W 1%	1061-0010	Allen Bradley
	Resistor, Metalfilm 100ohm 1/8W 1%	1061-0100	Allen Bradley

NEXT ASSY	USED ON
	732

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
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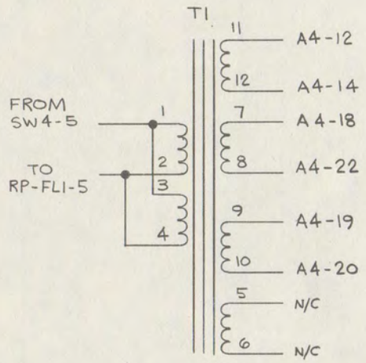
B	REVISED PER ECO # 136	RM			4-10-74

CHASSIS WIRING



A1 — I.F.

1	GND
2	A4-3
3	GND
4	FP-SW7-2
5	RP-J2 & A3-7
6	FP-SW1-1
7	TB2-2
8	A3-2
9	-15V
10	FP-M2-(-)
11	N/C
12	+15V
13	GND
14	FP-SW7-5 & RP-J3-F
15	FP-R4-3
16	FP-R4-1
17	FP-SW7-4
18	FP-R4-2
19	N/C
20	CH-A5-7
21	N/C
22	GND

A2 — PEAK FLASHER AND METER AMPL

1	GND
2	FP-SW1-2
3	N/C
4	N/C
5	+5V
6	FP-SW3-4
7	FP-SW3-3
8	FP-R1-2
9	FP-SW5-A
10	RP-J3-E
11	FP-CR2-1
12	FP-SW6-O
13	RP-J3-C & A3-15
14	FP-CR1-1
15	N/C
16	A3-6
17	-15V
18	FP-R2-2
19	+15V
20	FP-M1-(+)
21	RP-J3-A
22	GND, FP-M1-(-)

A3 — TELEMETRY

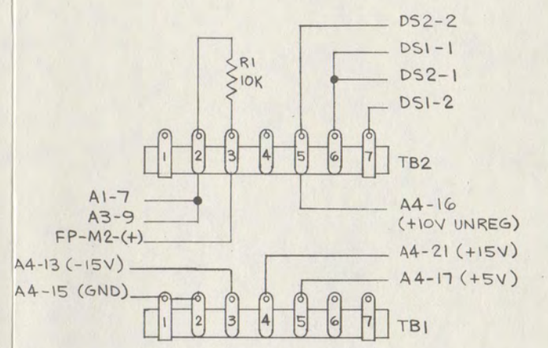
1	GND
2	A1-8
3	-15V
4	RP-J4-G
5	+15V
6	A2-16
7	A1-5
8	RP-J4-C
9	TB2-2
10	N/C
11	RP-SW1-3
12	RP-J4-D
13	N/C
14	+5V
15	A2-13
16	N/C
17	RP-J4-E
18	RP-J4-F
19	N/C
20	RP-J4-A
21	RP-J4-B
22	GND

A4 — POWER SUPPLY

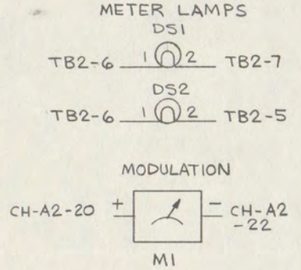
1	GND
2	CH-A5-3
3	CH-A1-2
4	GND
5	N/C
6	N/C
7	N/C
8	N/C
9	FP-SW1-3
10	N/C
11	N/C
12	T1-11
13	-15 TO BUSS TB1-3
14	T1-12
15	GND
16	+10V UNREG TO TB2-5
17	+5V TO BUSS TB1-5
18	T1-7
19	T1-9
20	T1-10
21	+15V TO BUSS TB1-4
22	T1-8

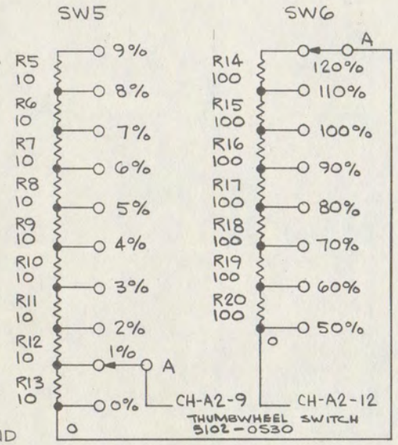
A5 — CARRIER FREQUENCY (OPTION)

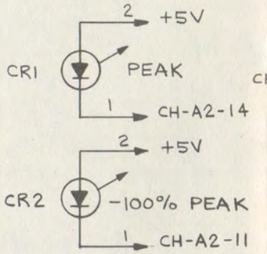
1	GND
2	+15V
3	CH-A4-2
4	N/C
5	FP-J1
6	N/C
7	CH-A1-20
8	N/C
9	-15V
10	GND
11	N/C
12	N/C
13	N/C
14	N/C
15	N/C
16	N/C
17	N/C
18	N/C
19	N/C
20	N/C
21	N/C
22	N/C

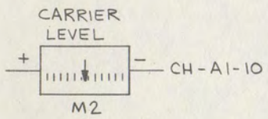


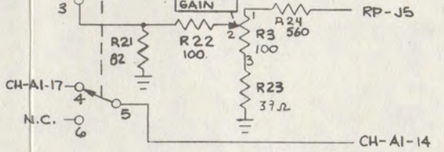
FRONT PANEL

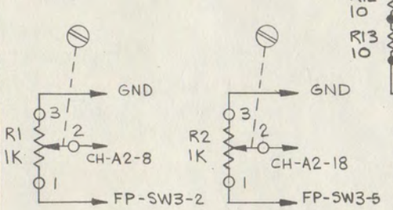


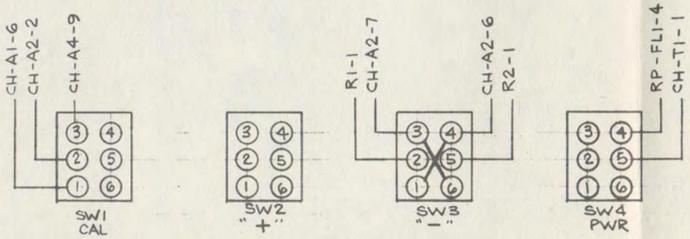


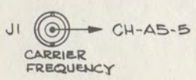


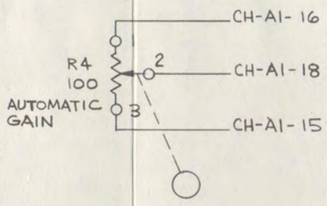












NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE, TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF DES.	QTY PER ASSY

LIST OF MATERIALS

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
.XX ± ANGULAR ±
.XXX ±

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3000 Olcott St., Santa Clara, California 95050
(408) 246-6365

TITLE FRONT PANEL & CHASSIS WIRING FIG 6-2

SIZE D | DRAWING NO. 6600-0440 | REV. B

SCALE NONE | SHT 1 OF 1

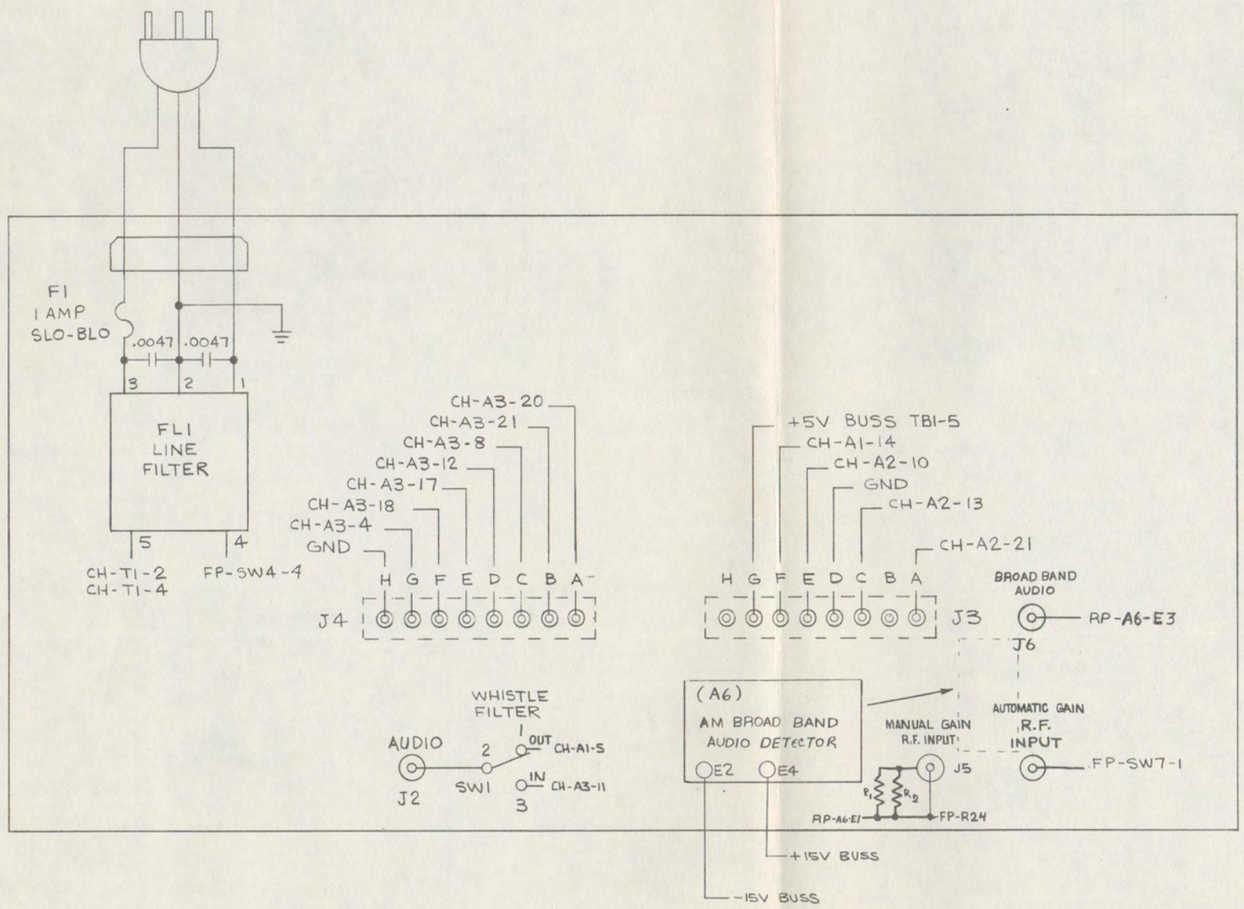
DWG. NO. 6600-044

REAR PANEL ASSEMBLY, MODEL 732, 5102-0380

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	Rear Panel	2003-0110	
J1	Connector, BNC	2200-7935	Kings
J2	Connector, BNC	2200-7935	Kings
J3	Terminal Block	1700-0008	Curtis
J4	Terminal Block	1700-0008	Curtis
J5	Connector, BNC	2200-7935	Kings
	Lug, GND	1710-1200	
SW1	Switch, Toggle, SPDT	1800-1020	C & K
	Lug, GND	1710-1010	
FL1	Filter, Line	1055-0001	Comp. Corp.
	Fuseholder	1910-0001	Buss
F1	Fuse, 1 AMP, Slo Blo	1900-0010	Buss
	Line Cord	1950-7239	
	Strain Relief	1975-0504	

NEXT ASSY	USED ON
	732

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
A	RELEASED TO PRODUCTION	RG			9-7-73
B	REVISED PER ECO # 136	RM			4-10-74



ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
QTY PER ASSY		LIST OF MATERIALS		

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TOLERANCES UNLESS OTHERWISE SPECIFIED
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.XXX ±

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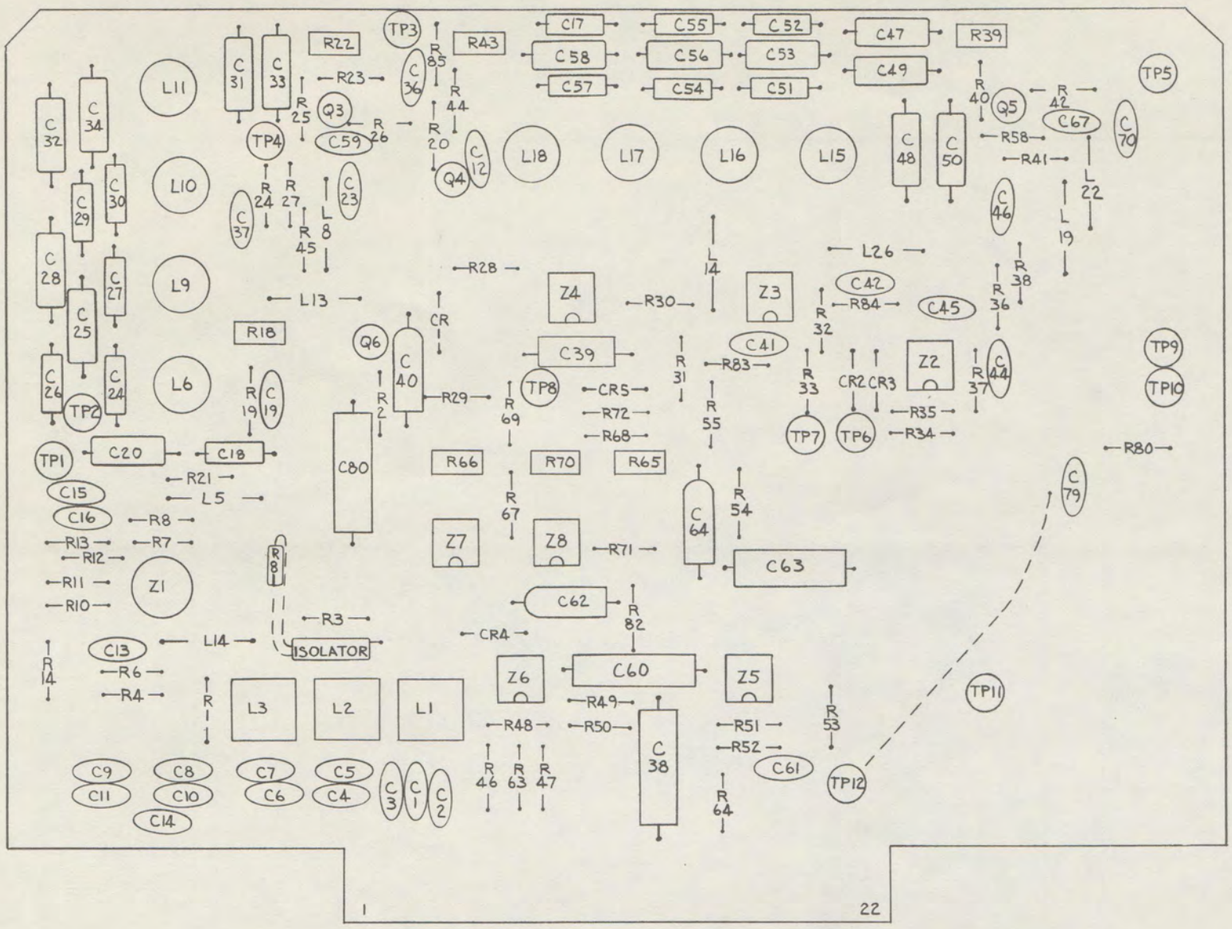
TITLE REAR PANEL WIRING DIAGRAM FIG 6-3

SIZE D | DRAWING NO. 6600-0430 | REV. B
SCALE NONE | SHT. 1 OF 1

DWG. NO. 6600-0430



I.F. BOARD ASSY

A1 6608-0201

A1, I.F. BOARD ASSEMBLY, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	DIODES		
CR1	Diode, IN4728	1250-4727	National
CR2	Diode, HPA2800	1251-2800	Hewlett Packard
CR3	Diode, HPA2800	1251-2800	Hewlett Packard
CR4	Diode, IN4728	1250-4727	National
CR5	Diode, IN4728	1250-4727	National
	COILS		
L1	Coil, Factory Select 25 1/2 T	1277-0002	
L2	Coil, Factory Select 25 1/2 T	1277-0002	
L3	Coil, Factory Select 25 1/2 T	1277-0002	
L4	Choke, 15 MH	1530-0150	Delevan
L5	Coil, Variable 45 1/2 Turns	1555-0045	Delevan
L6	Choke, 15 µH	1530-0150	Delevan
L7	Coil, Variable 45 1/2 Turns	1555-0045	
L8	Coil, Variable 45 1/2 Turns	1555-0045	
L9	Choke, 15 µH	1530-0150	Delevan
L10	Coil, Variable 45 1/2 Turns	1555-0045	
L11	Coil, Variable 45 1/2 Turns	1555-0045	
L12	Choke, 15 µH	1530-0150	Delevan
L13	Coil, Variable 45 1/2 Turns	1555-0045	
L14	Coil, Variable 45 1/2 Turns	1555-0045	
L15	Coil, Variable 45 1/2 Turns	1555-0045	
L16	Coil, Variable 45 1/2 Turns	1555-0045	
L17	Coil, Variable 45 1/2 Turns	1555-0045	
L18	Choke, 15 µH	1530-0150	Delevan
L19	Coil, Variable 45 1/2 Turns	1555-0045	
L22	Choke, 15 µH	1530-0150	Delevan
L26	Choke, 15 µH	1530-0150	Delevan
	TRANSISTORS		
Q1	Transistor, 2N2369	1251-2369	National
Q2	Transistor, 2N2369	1251-2369	National
Q3	Transistor, 2N2907	1251-2907	National
Q4	Transistor, 2N2907	1251-2907	National
Q5	Transistor, 2N2907	1251-2907	National
	RESISTORS		
R1	Resistor, 150 Ω 1/4w 5%	1065-0159	Allen Bradley
R2	Resistor, 150 Ω 1/4w 5%	1065-0159	Allen Bradley
R3	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R4	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R5	Resistor, 4.7K 1/4w 5%	1065-2351	Allen Bradley
R6	Resistor, 10K 1/4w 5%	1065-3051	Allen Bradley
R7	Resistor, 51 Ω 1/4w 5%	1065-0051	Allen Bradley
R8	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R13	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R14	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R18	Resistor, 5.6K 1/4w 5%	1065-2851	Allen Bradley
R19	Resistor, 5.6K 1/4w 5%	1065-2851	Allen Bradley
R30	Resistor, 75 Ω 1/4w 5%	1065-0075	Allen Bradley

A1, I.F. BOARD ASSEMBLY, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITORS		
C2	Capacitor, 1000 pf ± 2%	1002-4300	Elmenco
C3	Capacitor, 750 pf ± 2% Polystyrene	1002-7579	Elmenco
C4	Capacitor, 750 pf ± 2% Polystyrene	1002-7579	Elmenco
C5	Capacitor, 2pf Ceramic Disc.	1005-2029	Erie
C6	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C7	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C8	Capacitor, 10 pf Tantalum	1005-0100	Kemet
C9	Capacitor, 10 pf Tantalum	1005-0100	Kemet
C10	Capacitor, 1000 pf Dura- Mica	1001-2102	Elmenco
C11	Capacitor, 1000 pf Dura- Mica	1001-2102	Elmenco
C12	Capacitor, 220 pf Dura- Mica	1001-2221	Elmenco
C14	Capacitor, 220 pf Dura- Mica	1001-2221	Elmenco
C17	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C18	Capacitor, 750 pf ± 2% Polystyrene	1002-7579	Elmenco
C19	Capacitor, 750 pf ± 2% Polystyrene	1002-7579	Elmenco
C20	Capacitor, 1000 pf ± 2% Durmica	1002-4300	Elmenco
C23	Capacitor, 1000 pf ± 2% Durmica	1002-4300	Elmenco
C31	Capacitor, 43 pf ± 2% Durmica	1002-4349	Elmenco
C32	Capacitor, 43 pf ± 2% Durmica	1002-4349	Elmenco
C33	Capacitor, 620 pf ± 2% Durmica	1002-4349	Elmenco
C34	Capacitor, 20 pf Durmica	1002-4349	Elmenco
C36	Capacitor, 43 pf Durmica	1002-4349	Elmenco
C37	Capacitor, 43 pf Durmica	1002-4349	Elmenco
C39	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C40	Capacitor, 75 pf Polystyrene	1002-7579	Elmenco
C41	Capacitor, 1000 pf Dura- Mica	1001-2102	Elmenco
C42	Capacitor, 75 pf Polystyrene	1002-7579	Elmenco
C44	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C45	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C46	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C47	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C48	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C49	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C50	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C51	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C52	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C53	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C54	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C55	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C56	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C57	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C58	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C59	Capacitor, 10 µf Electrolytic	1016-4109	Sprague
C61	Capacitor, 10 µf Electrolytic	1016-4109	Sprague

A1, I.F. BOARD ASSEMBLY, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	RESISTORS		
R23	Resistor, 10K 1/4w ±%	1065-1002	Allen Bradley
R25	Resistor, 1K 1/4w ±%	1065-1001	Allen Bradley
R26	Resistor, 10K 1/4w ±%	1065-3001	Allen Bradley
R27	Resistor, 10K 1/4w ±%	1065-3003	Allen Bradley
R44	Resistor, 10K 1/4w ±%	1065-3003	Allen Bradley
R84	Resistor, 249K 1/4w ±%	1065-4481	Allen Bradley
	INTEGRATED CIRCUITS		
Z1	I.C. UA 796	1120-4796	Motorola
Z2	I.C. LM 301	1120-2801	National
Z3	I.C. LM 741	1120-0741	National
Z4	I.C. LM 741	1120-0741	National
Z5	I.C. LM 741	1120-0741	National
Z6	I.C. LM 741	1120-0741	National
Z7	I.C. LM 741	1120-0741	National
Z8	I.C. LM 741	1120-0741	National

A1, I.F. BOARD ASSEMBLY, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
A1	P.C. Board	1600-0200	
	CAPACITORS		
C1	Capacitor, Dur-Mica (Factory Select)		Elmenco
C2	Capacitor, Dur-Mica (Factory Select)		Elmenco
C3	Capacitor, Dur-Mica (Factory Select)		Elmenco
C4	Capacitor, Dur-Mica (Factory Select)		Elmenco
C5	Capacitor, Dur-Mica (Factory Select)		Elmenco
C6	Capacitor, Dur-Mica (Factory Select)		Elmenco
C7	Capacitor, Dur-Mica (Factory Select)		Elmenco
C8	Capacitor, Dur-Mica (Factory Select)		Elmenco
C9	Capacitor, Dur-Mica (Factory Select)		Elmenco
C10	Capacitor, Dur-Mica (Factory Select)		Elmenco
C11	Capacitor, Dur-Mica (Factory Select)		Elmenco
C12	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C13	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C14	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C15	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C16	Capacitor, 75 pf Polystyrene	1002-7579	Elmenco
C17	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C20	Capacitor, 620 pf	1002-4349	Elmenco
C23	Capacitor, 43 pf Durmica	1002-4349	Elmenco
C24	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C25	Capacitor, 2 pf Ceramic Disc.	1005-2029	Erie
C27	Capacitor, 68 pf Polystyrene	1002-4349	Elmenco
C28	Capacitor, 20 pf Polystyrene	1002-4349	Elmenco
C29	Capacitor, 43 pf Polystyrene	1002-4349	Elmenco
C30	Capacitor, 1000 pf ± 2% Polystyrene	1002-4300	Elmenco
C31	Capacitor, 1000 pf ± 2% Polystyrene	1002-4300	Elmenco

A1, I.F. BOARD ASSEMBLY, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	RESISTORS		
R21	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R22	Resistor, 1.5K 1/4w 5% 1K	1065-1551	Allen Bradley
R23	Resistor, 3.3K 1/4w 5%	1065-3351	Allen Bradley
R24	Resistor, 5.6K 1/4w 5%	1065-5651	Allen Bradley
R27	Resistor, 100 Ω 1/4w 5%	1065-0101	Allen Bradley
R28	Resistor, 2.49K 1/4w 5% 1K	1065-2491	Allen Bradley
R29	Resistor, 3.3K 1/4w 5%	1065-3351	Allen Bradley
R31	Resistor, 3.3K 1/4w 5% 1K	1065-3351	Allen Bradley
R32	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R33	Resistor, 2.49K 1/4w 5% 1K	1065-2491	Allen Bradley
R34	Resistor, 100 Ω 1/4w 5%	1065-0101	Allen Bradley
R35	Resistor, 100 Ω 1/4w 5%	1065-0101	Allen Bradley
R36	Resistor, 3.3K 1/4w 5%	1065-3351	Allen Bradley
R37	Resistor, 3.3K 1/4w 5%	1065-3351	Allen Bradley
R38	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R40	Resistor, 1K 1/4w 5%	1065-1051	Allen Bradley
R41	Resistor, 100 Ω 1/4w 5%	1065-0101	Allen Bradley
R42	Resistor, 100 Ω 1/4w 5%	1065-0101	Allen Bradley
R43	Resistor, 2.49K 1/4w 5% 1K	1065-2491	Allen Bradley
R44	Resistor, 100 Ω 1/4w 5%	1065-0101	Allen Bradley
R45	Resistor, 2.49K 1/4w 5% 1K	1065-2491	Allen Bradley
R46	Resistor, Potentiometer	1072-0100	CTS
R47	Resistor, 270 Ω 1/4w 5%	1065-2701	Allen Bradley
R48	Resistor, 2.7K 1/4w 5%	1065-2751	Allen Bradley
R49	Resistor, Potentiometer 100 Ω	1072-0100	CTS
R50	Resistor, 2.2K 1/4w 5%	1065-2251	Allen Bradley

REVISIONS		
LTR	Description	Date
A		

FP-SW7-2 RF INPUT

GND

-15V

LO INPUT 0.2V RMS CH-A4-3

+15V

AGC FP-SW 7-5 RP-J3-F

FP-SW 7-4 AGC VOLTAGE 2-5 VOLTS WITH SIGNAL INPUT

FP-R4-2 AGC REF. VOLTAGE

XX-J2 CH-A3-7 AUDIO OUTPUT

CH-A3-2 AUDIO OUTPUT

FP-SW1-1 AUDIO OUTPUT

FP-M1 CARRIER LEVEL

CH-TB2-3

CH-R1 10K

CH-TB2-2

CH-A3-9

FP-R4-3 CARRIER LEVEL 100 = 80T FP-R4-1

P/O P1

R80 1K

C79 .05

20 IF OUTPUT CH-A5-7

NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C81	C21,22,35,43,65,66,68,69,71, 72,73,74,75,76,77,78,
R1	R85	R5, 15,16,17,56,57,59,60,61, 62,73,74,75,76,77,78,79,
CR1	CR5	
L1	L26	L5,7,12,20,21,23,24,25
Q3	Q6	Q1,2,
Z1	Z8	

TFT TIME AND FREQUENCY TECHNOLOGY, INC.
2950 SCOTT BLVD., SANTA CLARA, CA 95050 (408) 246-6385

SCALE —	APPROVED BY	DRAWN BY D.S.
DATE 7-12-73		REVISED

(A1) SCHEMATIC - I.F. BOARD

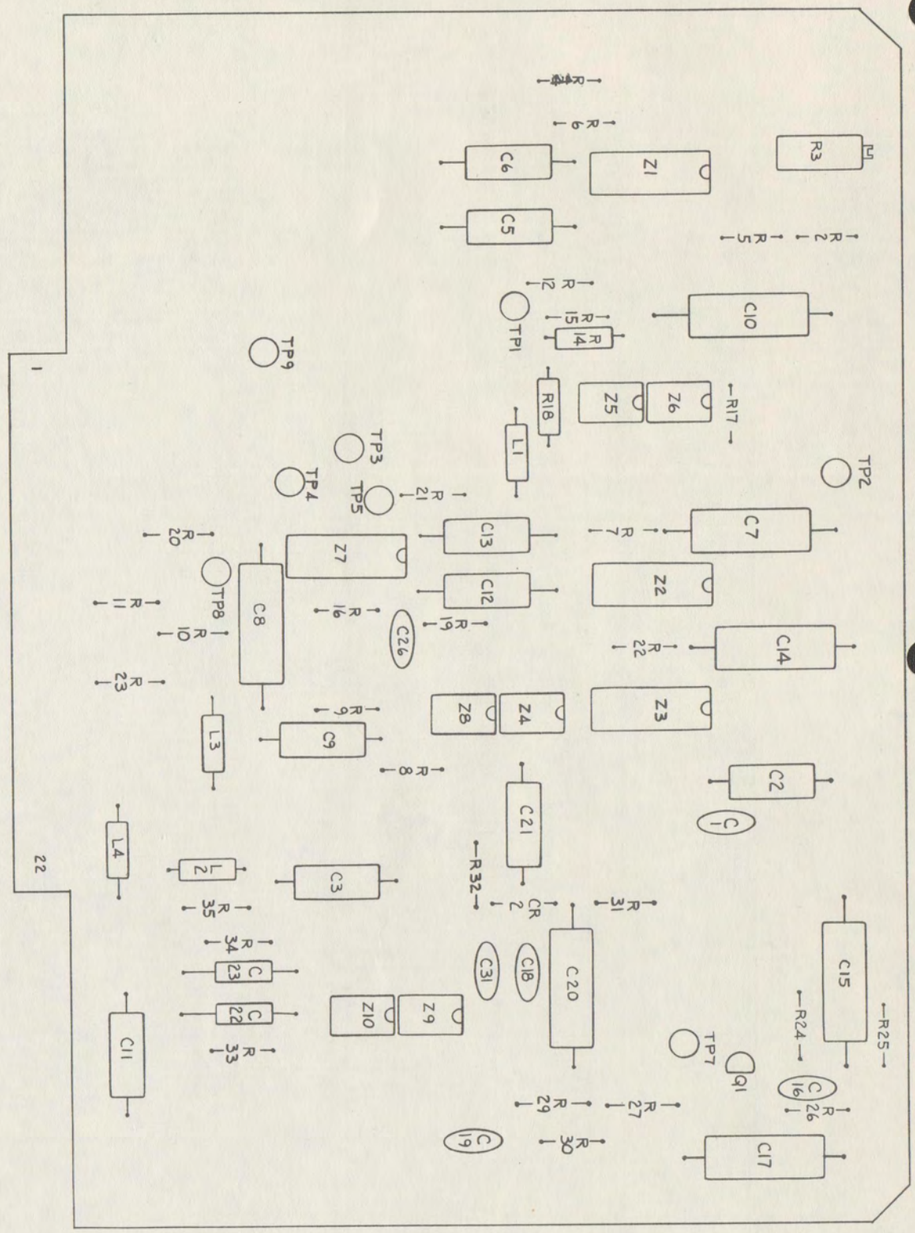
MODEL 732 FIG. 6-4 | DRAWING NUMBER 6001-1160 A

A2, PEAK FLASHER AND AUDIO AMP, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	P.C. Board	1600-0029	
	CAPACITORS		
C1	Capacitor, .05 µf Ceramic D sc.	1005-5039	Erie
C2	Capacitor, 15 µf Electrolytic	1010-0150	Sprague
C3	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C5	Capacitor, 15 µf Electrolytic	1010-0150	Sprague
C6	Capacitor, 15 µf Electrolytic	1010-0150	Sprague
C7	Capacitor, 250 µf Electrolytic	1010-0251	Sprague
C8	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C9	Capacitor, 1.0 µf Electrolytic	1010-0010	Sprague
C10	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C11	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C12	Capacitor, 15 µf Electrolytic	1010-0150	Sprague
C13	Capacitor, 15 µf Electrolytic	1010-0150	Sprague
C14	Capacitor, 250 µf Electrolytic	1010-0251	Sprague
C15	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C16	Capacitor, 820 pf Dura Mica	1001-0821	Elmenco
C17	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C18	Capacitor, 15 pf 300V, Dura Mica	1001-0150	Sprague
C19	Capacitor, .027 µf	1002-2739	Sprague
C20	Capacitor, 100 µf Electrolytic	1010-0101	Sprague
C21	Capacitor, 6.6 µf Tantalum	1008-0056	Kemet
C22	Capacitor, 6.6 µf Tantalum	1008-0065	Kemet
C23	Capacitor, 6.8 µf Tantalum	1008-0068	Kemet
C26	Capacitor, 1000 pf 500V, Dura Mica	1001-0102	Elmenco
C31	Capacitor, 51 pf 500V, Dura Mica	1001-0150	Elmenco
	DIODES		
CR2	Diode HPA-2800	1282-2800	Hewlett Packard
L1	Choke, 15 µH	1530-0150	Delevan
L2	Choke, 1 1/2 Turns	1530-0025	Delevan
L3	Choke, 100 µH	1530-0101	Delevan
L4	Choke, 15 µH	1530-0150	Delevan
	TRANSISTORS		
Q1	Transistor, 2N 3568	1271-3563	National
	RESISTORS		
R2	Resistor, 6.81K 1/8w 1%	1061-6801	Dale
R3	Resistor, Potentiometer 500 Ω 10 T	1067-0500	Allen Bradley

A2, PEAK FLASHER AND AUDIO AMP, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	RESISTORS		
R4	Resistor, 1K 1/4w ± 5%	1065-1001	Allen Bradley
R5	Resistor, 560 Ω 1/4w ± 5%	1065-0560	Allen Bradley
R6	Resistor, 2.2K 1/4w 5%	1065-2201	Allen Bradley
R7	Resistor, 6.8K 1/4w 5%	1065-6801	Allen Bradley
R8	Resistor, 12K 1/4w 5%	1065-1202	Allen Bradley
R9	Resistor, 2.2K 1/4w 5%	1065-2201	Allen Bradley
R10	Resistor, 1.5K 1/8w 1%	1061-1501	Dale
R11	Resistor, 150 Ω 1/4w 5%	1065-0150	Allen Bradley
R12	Resistor, 10 Ω 1/8w 1%	1061-0010	Dale
R14	Resistor, 10K 1/8w .25%	1059-1002	Dale
R15	Resistor, 10K 1/4w 5%	1065-1002	Allen Bradley
R16	Resistor, 1K 1/4w 5%	1065-1001	Allen Bradley
R17	Resistor, 10 Ω 1/8w 1%	1061-0010	Allen Bradley
R18	Resistor, 10K 1/8w .25%	1059-1002	Allen Bradley
R19	Resistor, 560 Ω 1/4w 5%	1065-0560	Allen Bradley
R20	Resistor, 10K 1/4w 5%	1065-1002	Allen Bradley
R21	Resistor, 2.2K 1/4w 5%	1065-2201	Allen Bradley
R22	Resistor, 6.8K 1/4w 5%	1065-6801	Allen Bradley
R24	Resistor, 100K 1/4w 5%	1065-1003	Allen Bradley
R25	Resistor, 100K 1/4w 5%	1065-1003	Allen Bradley
R26	Resistor, 6.8K 1/4w 5%	1065-6801	Allen Bradley
R27	Resistor, 6.81K 1/8w 1%	1061-6801	Allen Bradley
R28	Resistor, 150 Ω 1/4w 5%	1065-0150	Allen Bradley
R29	Resistor, 24.3K 1/8w 1%	1061-2432	Dale
R30	Resistor, 160K 1/4w 5%	1065-1603	Allen Bradley
R31	Resistor, 1K 1/4w 5%	1065-1002	Allen Bradley
R32	Resistor, 36K 1/4w 5%	1065-3602	Allen Bradley
R33	Resistor, 12K 1/4w 5%	1065-1202	Allen Bradley
R34	Resistor, 12K 1/4w 5%	1065-1202	Allen Bradley
R35	Resistor, 4.7 1/4w 5%	1065-4701	Allen Bradley
	INTEGRATED CIRCUITS		
Z1	I.C. LM 710	1100-0710	National
Z2	I.C. SP 380	1100-0380	Signetics
Z3	I.C. SN7400	1100-7400	Signetics
Z4	I.C. T5451P	1100-7551	T.I.
Z5	I.C. LM 741	1100-0741	National
Z6	I.C. LM 741	1100-0741	National
Z7	I.C. LM 710	1100-0710	National
Z8	I.C. LM 741	1100-0741	National
Z9	I.C. LM 301	1100-0301	National
Z10	I.C. LM 741	1100-0741	National



PEAK FLASHER AND METER AMP.

A2

6608-0181

REVISIONS		
LTR	Description	Date

AUDIO INPUT
FP-SW1-2
4.5 VPP
@ 100% MODULATION

PEAK FLASHER INPUT
FROM RP-R1-2
3.0 VPP
@ 100% MODULATION

- AUDIO TO ± SWITCH
F.P.-SW3-3
3.6 VPP @ 100% MODULATION

+ AUDIO TO ± SWITCH
F.P.-SW3-4
3.6 VPP @ 100% MODULATION

MODULATION METER
INPUT F.P.-22-2
3.0 VPP @ 100% MODULATION

P/O P1 pin 9 — TO THUMBWHEEL SWITCHES F.P.-SW5-A 2.52 to 4.0 VOLTS

P/O P1 pin 11 — TO 100% PEAK LAMP F.P.-CR2-1 (+5V)

FRONT PANEL THUMBWHEEL SWITCH

P/O P1 pin 10 — TO REMOTE READOUT PANEL RP-J3-E

P/O P1 pin 15 — N.C.

P/O P1 pin 12 — FROM THUMBWHEEL SWITCHES F.P.-SW6-0 2.52 VOLTS DC

P/O P1 pin 14 — TO PEAK FLASHER F.P.-CR1-1 (+5V)

P/O P1 pin 13 — TO REMOTE READOUT PANEL RP-J3-C & C11-A3-15

P/O P1 pin 16 — MODULATION OUTPUT TO A3-6

P/O P1 pin 21 — TO REMOTE READOUT PANEL RP-J3-A

P/O P1 pin 20 — TO MODULATION METER F.P.-M1-(+)

COMPONENT DESIGNATOR		
FIRST	LAST	DELETED
C1	C51	C4, C22, 27-30
L1	L6	
Q1	Q4	1
R2	R35	R18, R23, R21, R24
E1	E10	

SN7400 pinout: VCC, GND

SP380A pinout: GND, VCC

NOTES; UNLESS OTHERWISE SPECIFIED;
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE, TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

MODEL 732

DESIGN	APPROVED BY	DRAWN BY C.L.
DATE 7-2-73		DATE 11-9-72

PEAK FLASHER & METER AMP (A2)

FIG. 6-5 — 6601-1170

A3, TELEMETRY BOARD, MODEL 732 6608-0220

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
A8	P.C. Board	1600-0032	TFT
	CAPACITORS		
C1	Capacitor, 15 µf-25V Electrolytic	1010-0150	Sprague
C5	Capacitor, 15 µf-25V Electrolytic	1010-0150	Sprague
C8	Capacitor, 15 µf-25V Electrolytic	1010-0150	Sprague
	DIODES		
CR1	Diode, IN 3064 Si-Diode	1281-3064	FSC
	RELAYS		
K1	PRB-3510, Relay	1880-0001	Clave
	COILS		
L1	15 mHy ± 20% Molded R. F. Coil	1530-0150	Delevan
L2	15 mHy ± 20% Molded R. F. Coil	1530-0150	Delevan
L3	15 mHy ± 20% Molded R. F. Coil	1530-0150	Delevan

A3, TELEMETRY LOWPASS OPTION, MODEL 732 6608-0221

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITORS		
C2	1 µf ± 10% 100V Mylar	1004-0001	TRW
C3	6.8 µf ± 10% 35V Tantalum	1008-0068	Kemet
C4	.027 µf ± 10% 100V Polyester	1002-2739	Sprague
	RESISTORS		
R1	Resistor, 10K ± 5% 1/4w Carbon Comp	1065-1002	AB
R2	Resistor, 10K ± 5% 1/4w Carbon Comp	1065-1002	AB
R3	Resistor, 10K ± 1/4w Carbon Comp	1065-1002	AB
R4	Resistor, 10K ± 1/4w Carbon Comp	1065-1002	AB
R5	Resistor, 9.1K ± 5% 1/4w Carbon Comp	1065-9101	AB
R6	Resistor, 8.2K ± 5% 1/4w Carbon Comp	1065-8201	AB
R7	Resistor, 47K ± 5% 1/4w Carbon Comp	1065-4702	AB
R8	Resistor, 560 ± 5% 1/4w Carbon Comp	1065-0560	AB
	INTEGRATED CIRCUITS		
Z5	I.C. LM 741	1100-0741	National
Z6	I.C. LM 741	1100-0741	National

A3, CARRIER POWER ALARM OPTION, MODEL 732 6608-0222

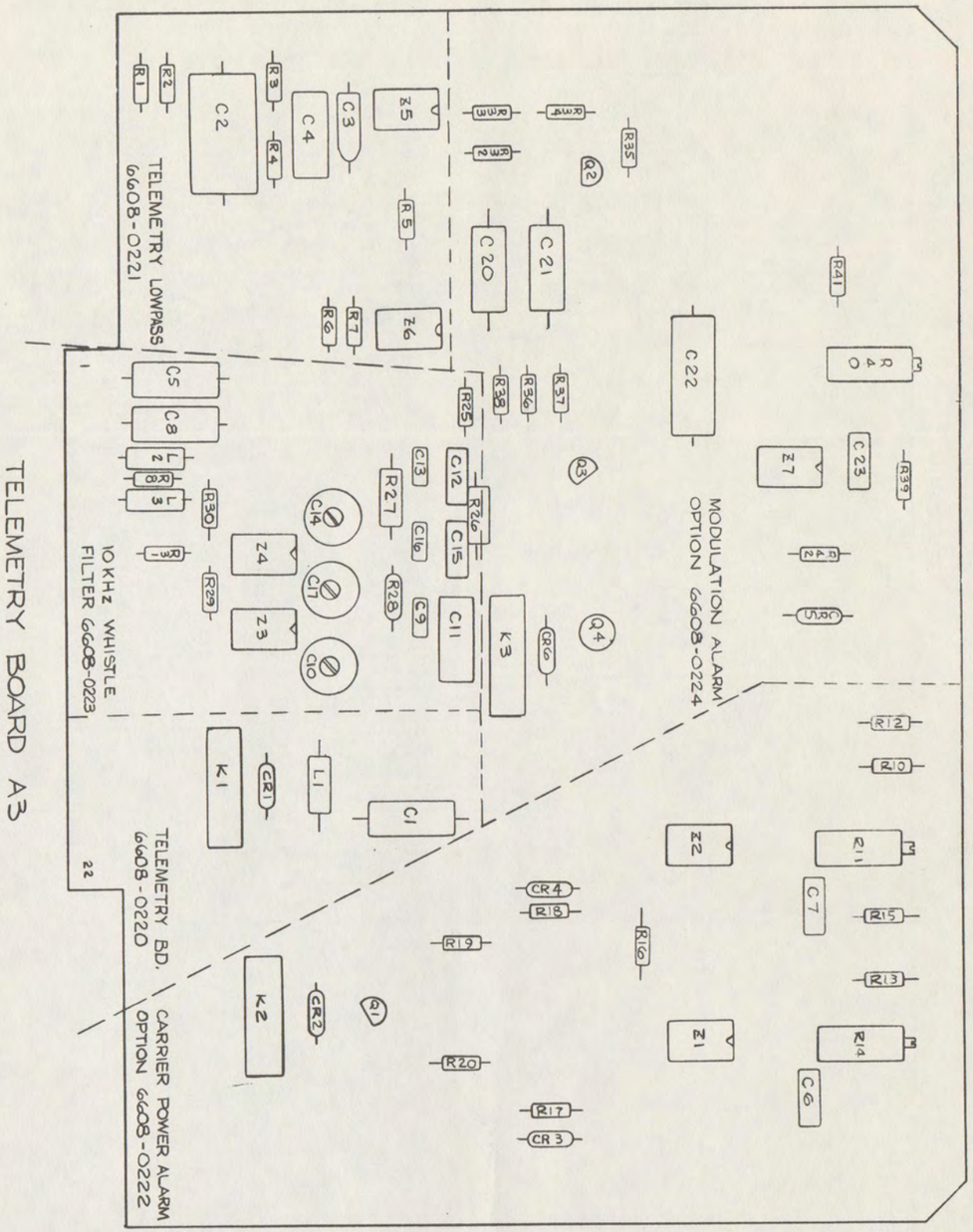
CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITORS		
C6	Capacitor, 1000 pf ± 5% 500V Dipped Mica	1001-0100	Elmenco
C7	Capacitor, 1000 pf ± 5% 500V Dipped Mica	1001-0100	Elmenco
	DIODES		
CR2	Diode, IN 3064 Si-Diode	1281-3064	FSC
CR3	Diode, IN 3064 Si-Diode	1281-3064	FSC
CR4	Diode, IN 3064 Si-Diode	1281-3064	FSC
	RELAYS		
K2	Relay, PRB 3510	1880-0001	Clare
	RESISTORS		
R10	Resistor, 12K ± 5% 1/4w Carbon Comp	1065-1202	AB
R11	Resistor, 1K Potentiometer Cermet	1069-1001	Beckman
R12	Resistor, 2.7 ± 5% 1/4 w Carbon Comp	1065-2701	AB
R13	Resistor, 13K ± 5% 1/4 w Carbon Comp	1065-1302	AB
R14	Resistor, 1K Potentiometer Cermet	1069-1001	Beckman
R15	Resistor, 750 ohms ± 5% 1/4w Carbon Comp	1065-0750	AB
R16	Resistor, 10K ± 5% 1/4w Carbon Comp	1065-1002	AB
R17	Resistor, 1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R18	Resistor, 1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R19	Resistor, 1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R20	Resistor, 1K ± 5% 1/4w Carbon Comp	1065-1001	AB
	TRANSISTORS		
Q1	Transistor, 2N3567 Si NPN	1271-3567	National
	INTEGRATED CIRCUITS		
Z1	I.C. LM 741	1100-0741	National
Z2	I.C. LM 741	1100-0741	National

A3, 10KHz WHISTLE FILTER (OPTION), MODEL 732 6608-0223

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITORS		
C9	Capacitor, 100 pf ± 5% Duramica	1001-0101	Elmenco
C10	Capacitor, 9-35 pf Trimmer Cap	1012-9035	Erie
C11	Capacitor, 2000 pf ± 5% Duramica	1001-0202	Elmenco
C12	Capacitor, 1000 pf ± 5% Duramica	1001-0102	Elmenco
C13	Capacitor, 39 pf ± 5% Duramica	1001-0390	Elmenco
C14	Capacitor, 9-35 pf Trimmer Cap	1012-9035	Erie
C15	Capacitor, 1000 pf ± 5% Duramica	1001-0102	Elmenco
C16	Capacitor, 39 pf ± 5% Duramica	1001-0390	Erie
C17	Capacitor, 9-35 pf Trimmer Cap	1012-9035	Erie
	RESISTORS		
R25	10K ± 5% 1/4w Carbon Comp	1065-1002	AB
R26	15K ± 1% 1/8w Metal Film Res	1061-1502	Dale
R27	15K ± 1% 1/8w Metal Film Res	1061-1502	Dale
R28	7.5K ± 1% 1/8w Metal Film Res	1061-7501	Dale
R29	1K ± 5% 1/4 w Carbon Comp Res	1065-1001	AB
R30	10K 5% 1/4w Carbon Comp Res	1065-1002	AB
R31	56 ohms ± 5% 1/4w Carbon Comp Res	1065-0560	AB
	INTEGRATED CIRCUITS		
Z3	I.C. LM 741	1100-0741	National
Z4	I.C. LM 741	1100-0741	National

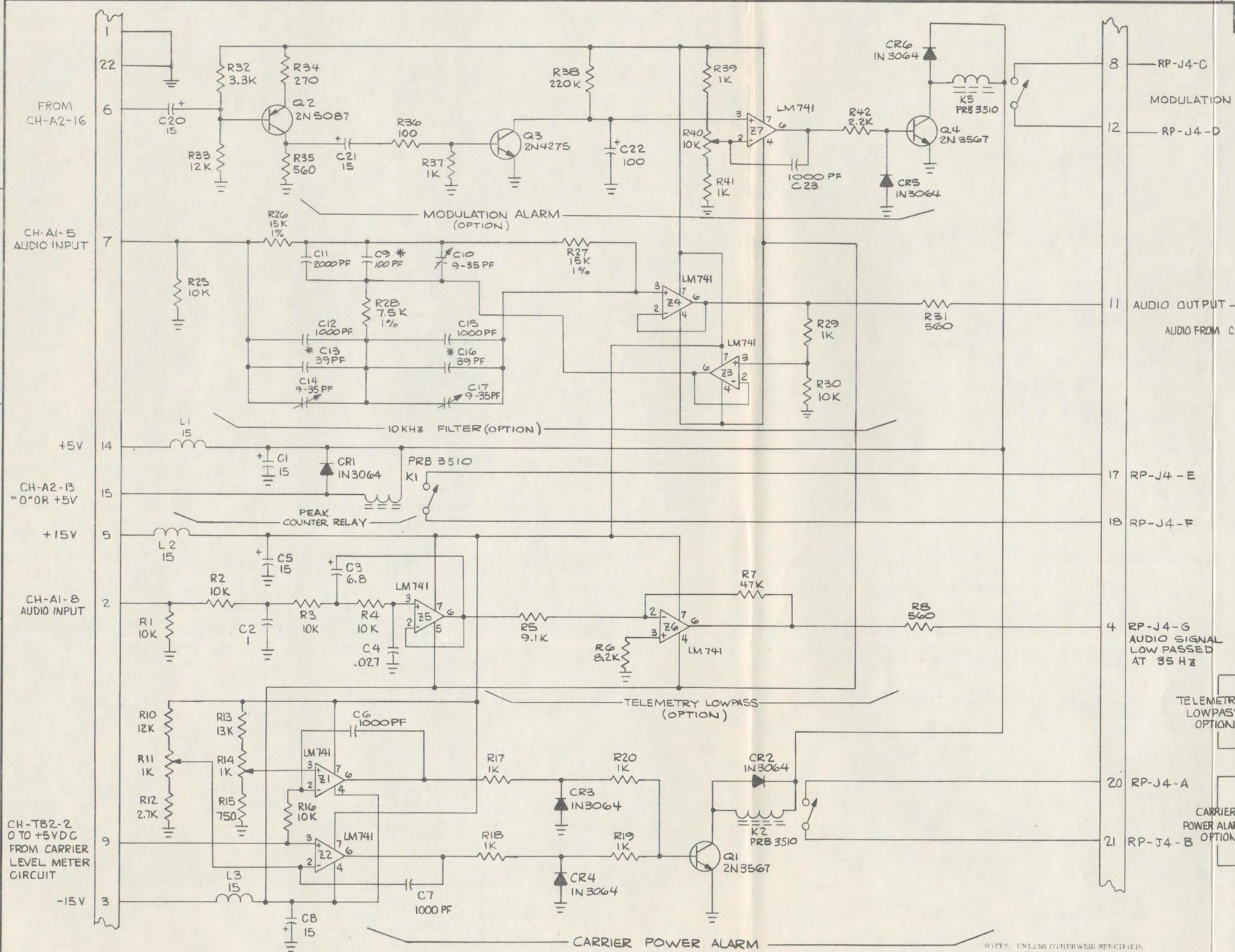
A3, MODULATION ALARM(OPTION) MODEL 732 6608-0224

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	CAPACITORS		
C20	15 pf 25V Electrolytic	1010-0150	Sprague
C21	15pf. 25V Electrolytic	1010-0150	Sprague
C22	100 pf 16V Electrolytic	1010-0101	Sprague
C23	1000 pf ± 5% D. M.	1001-0102	Elmenco
	DIODES		
CR5	IN 3064 Si Diode	1281-3064	FSC
CR6	IN 3064 Si Diode	1281-3064	FSC
	RELAYS		
K3	PRB 3510 Relay	1880-0001	Clave
	TRANSISTORS		
Q2	Transistor, 2N5087 Si PNP	1271-5087	Motorola
Q3	Transistor, 2N4275 Si NPN	1271-4275	National
Q4	Transistor, 2N3567 Si NPN	1271-3567	National
	RESISTORS		
R32	3.3K ± 5% 1/4w Carbon Comp	1065-3301	AB
R33	12K ± 5% 1/4w Carbon Comp	1065-1202	AB
R34	270 ohms ± 5% 1/4w Carbon Comp	1065-0270	AB
R35	560 ohms ± 5% 1/4w Carbon Comp	1065-0560	AB
R36	1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R37	1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R38	100K ± 5% 1/4w Carbon Comp	1065-1003	AB
R39	1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R40	10K Potentiometer 20 Turn Cermet	1069-1002	Beckman
R41	1K ± 5% 1/4w Carbon Comp	1065-1001	AB
R42	2.2K ± 5% 1/4w Carbon Comp	1065-2201	AB
	INTEGRATED CIRCUITS		
Z7	I.C. LM 741	1100-0741	National



NEXT ASSY	USED ON
6608-0220	732

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
B	REVISED & REDRAWN ECO #47	RG			3-22-73



COMPONENT DESIGNATOR	FIRST	LAST	DELETED
TELEMETRY LOWPASS OPTION	C2	C4	
	R1	R8	
	Z5	Z6	
CARRIER POWER ALARM OPTION	C6	C7	
	CR2	CR4	
	K2	K2	
	Q1	Q1	
	R10	R20	
	Z1	Z2	

COMPONENT DESIGNATOR	FIRST	LAST	DELETED
MODULATION ALARM OPTION	C20	C23	
	CR5	CR6	
	Q2	Q4	
	K3	K3	
	R32	R42	
	Z7	Z7	
10 KHz FILTER	C9	C17	
	R25	R31	
	Z3	Z4	
PEAK COUNTER RELAY	C1, C5	C8	
	CR1	CR1	
	K1	K1	
	L1	L3	

NOTES, UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

QTY PER ASSY	ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
			LIST OF MATERIALS		

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
.xx ± ANGULAR
.xxx± ±

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DRAWN BY R.G. DATE 3-22-73
CHK. BY
PROJ. ENG.
MFG. ENG.
APPD.
APPD.
ECO NO.

TFT TIME & FREQUENCY TECHNOLOGY INC.
3000 Olcott St., Santa Clara, California 95050
(408) 246-6365

TITLE TELEMETRY BD. A3 FIG 6-6

SIZE D DRAWING NO. 6601-1150 REV. B
SCALE ~ SHT 1 OF 1

DWG. NO. 6601-0053

A4, POWER SUPPLY AND L.O. BOARD, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	P.C. Board	1600-0610	
	CAPACITORS		
C1	Capacitor, 500 μf Electrolytic	1010-0501	Sprague
C2	Capacitor, 10 μf Tantalum	1008-0100	Kemet
C3	Capacitor, .05 μf Ceramic Disc.	1005-5039	Erie
C4	Capacitor, .05 μf Ceramic Disc.	1005-5039	Erie
C5	Capacitor, .05 μf Ceramic Disc.	1005-5039	Erie
C6	Capacitor, 10 μf Tantalum	1008-0100	Kemet
C7	Capacitor, 4700 pf Dur-Mica 500V	1001-0472	Elmenco
C8	Capacitor, 20 pf Dur-Mica 500V	1001-0200	Elmenco
C9	Capacitor, 1000 pf Dur-Mica 500V	1001-0102	Elmenco
C10	Capacitor, 500 μf Electrolytic	1010-0501	Sprague
C11	Capacitor, 10 μf Tantalum	1008-0100	Kemet
C12	Capacitor, .068 μf Polyester	1002-6839	Sprague
C13	Capacitor, .068 μf Polyester	1002-6839	Sprague
C14	Capacitor, .027 μf Polyester	1002-2739	Sprague
C15	Capacitor, .15 μf Electrolytic	1002-1529	Erie
C16	Capacitor, .001 μf Polyester	1002-1039	Sprague
C17	Capacitor, 10 μf Tantalum	1008-0100	Kemet
C18	Capacitor, 500 μf Electrolytic	1010-0501	Sprague
C19	Capacitor, 10 μf Tantalum	1008-0100	Kemet
C20	Capacitor, 15 pf, 500V, Durmica	1001-0150	Elmenco
C21	Capacitor, .05 μf Ceramic Disc.	1005-5039	Erie
	RECTIFIERS		
CR1	Rectifier, SBR-05-M	1284-9505	Semtech
CR2	Rectifier, SBR-05-M	1284-9505	Semtech
CR3	Rectifier, SBR-05-M	1284-9505	Semtech
	INDUCTORS		
L1	Choke, 15 μH	1530-0150	Delevan
	RESISTORS		
R1	Resistor, 3.9K 1/4w± 5%	1065-3901	Allen Bradley
R2	Resistor, 100 Ω 1/4w ± 5%	1065-0100	Allen Bradley
R3	Resistor, 4.7K 1/4w ± 5%	1065-4701	Allen Bradley
R4	Resistor, 10K 1/4w ± 5%	1065-1002	Allen Bradley
R5	Resistor, 1K 1/4w± 5%	1065-1001	Allen Bradley

A4, POWER SUPPLY AND L.O. BOARD, MODEL 732

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
	RESISTORS		
R6	Resistor, 9.1K 1/4w ±5%	1065-9101	Allen Bradley
R7	Resistor, 10K 1/4w± 5%	1065-1002	Allen Bradley
R8	Resistor, 1K 1/4w±5%	1065-1001	Allen Bradley
R9	Resistor, 4.7K 1/4w ± 5%	1065-4701	Allen Bradley
R10	Resistor, 10K 1/4w ± 5%	1065-1002	Allen Bradley
R11	Resistor, 470 Ω 1/4w ± 5%	1065-0470	Allen Bradley
R12	Resistor, 10K 1/4w ± 5%	1065-1002	Allen Bradley
R13	Resistor, 10K 1/4w 5%	1065-1002	Allen Bradley
R14	Resistor, 10K 1/4w 5%	1065-1002	Allen Bradley
R15	Resistor, Potentiometer 1K 1/4w 5%	1069-1001	Beckman
R16	Resistor, Potentiometer 10K 1/4w 5%	1069-1002	Beckman
R17	Resistor, 27K 1/4w ± 5%	1065-2702	Allen Bradley
R18	Resistor, 4.7K 1/4w ± 5%	1065-4701	Allen Bradley
R19	Resistor, 4.7K 1/4w ± 5%	1065-4701	Allen Bradley
R20	Resistor, 19 Ω 1/2w ±1%	1067-0010	Allen Bradley
R21	Resistor, 3.32K 1/8w ± 1%	1061-3301	Dale
R22	Resistor, 1.5K 1/8w 1%	1061-1501	Dale
R23	Resistor, 1K 1/4w 5%	1065-1001	Allen Bradley
R24	Resistor, Potentiometer 2K	1069-2001	Beckman
Y1	Crystal, (Factory Select)	2400-XXXX	
	INTEGRATED CIRCUITS		
Z1	L.C. 7815	1100-7815	Motorola
Z2	L.C. 7815	1100-7815	Motorola
Z3	L.C. CA3028A	1100-3028	RCA
Z4	L.C. 7905	1100-7905	Motorola
Z5	L.C. LM 741	1100-0741	National
Z6	L.C. LM 741	1100-0741	National
	TRANSISTORS		
Q1	Transistors, 2N4275	1271-4275	National
Q2	Transistors, 2N4275	1271-4275	National
Q3	Transistors, 2N4275	1271-4275	National

POWER SUPPLY AND L.O. BOARD

6608 -0750 A4

NEXT ASSY	USED ON
6608-0750	732

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
B	REVISED PER ECO 132	RS			2-11-74

TWISTED PAIR FROM POWER TRANSFORMER CH-T1-9 CH-T1-10

TWISTED PAIR FROM POWER TRANSFORMER CH-T1-11 CH-T1-12

TWISTED PAIR FROM POWER TRANSFORMER CH-T1-7 CH-T1-8

R20 10 1/2 W

CR1 SBR-05M

CR2 SBR-05M

CR3 SBR-05M

7815 Z1

7815 Z2

7805 Z4

C1 500 · C2 10 · C10 500 · C11 10 · C18 500 · C19 10

L1 15

R1 3.9K · R2 100 · R3 4.7K · C3 .05 · C4 .05 · R23 1K · C21 .05 · R4 10K · C5 .05 · C6 10

Z3 CA3028A · +10V

Y1 F.O. · C20 15pf · C8 20pf · C7 470pf · C9 1000pf

R24 2K · R5 1K · R6 9.1K · R7 10K · R8 1K · R11 470 · C12 .068 · C13 .068 · R9 4.7K · R12 10K · R13 10K · C15 .15 · C14 .027 · R14 10K · C16 .001

Q1 2N4275 · Q2 2N4275 · Q3 2N4275 · R10 10K

Z5 741 · R21 3.32K 1% · C17 10

CAL A.C. · R22 1.5K 1% · R15 1K

Z6 741 · R16 10K · R17 27K · R18 4.7K

CAL DC · R19 4.7K

1	GND
21	+15V TO CH-TB1-4
3	L.O. OUTPUT TO CH-A1-2
2	CH-A5-3
4	GND
13	-15V TO CH-TB1-3
16	+10V TB2-5
15	GND
17	+5V TO CH-TB1-5
9	1KHz CAL SIGNAL TO SW1-3

COMPONENT DESIGNATOR	
FIRST	LAST
C1	C21
Q1	Q3
R1	R24
Y1	
L1	
Z1	Z6
CR1	CR3

NOTES; UNLESS OTHERWISE SPECIFIED:
1. **RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.**
2. **CAPACITORS - VALUES IN MICROFARADS.**
3. **INDUCTORS - VALUES IN MICROHENRYS ±10%**
4. ***FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.**
5. **VOLTAGES ARE DC CONDITIONS.**

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.	QTY PER ASSY

LIST OF MATERIALS

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED .xx ± .xxx ± ANGULAR ±

DO NOT SCALE THIS PRINT

DRAWN BY	Ann Ballard	DATE 6/1/73
CHK. BY		
PROJ. ENG.		
MFG. ENG.		
APPD.		
APPD.		
ECO NO.		

TFT TIME & FREQUENCY TECHNOLOGY INC.
3000 Olcott St., Santa Clara, California 95050 (408) 246-6365

TITLE (A4) POWER SUPPLY & L.O. BOARD MODEL 732

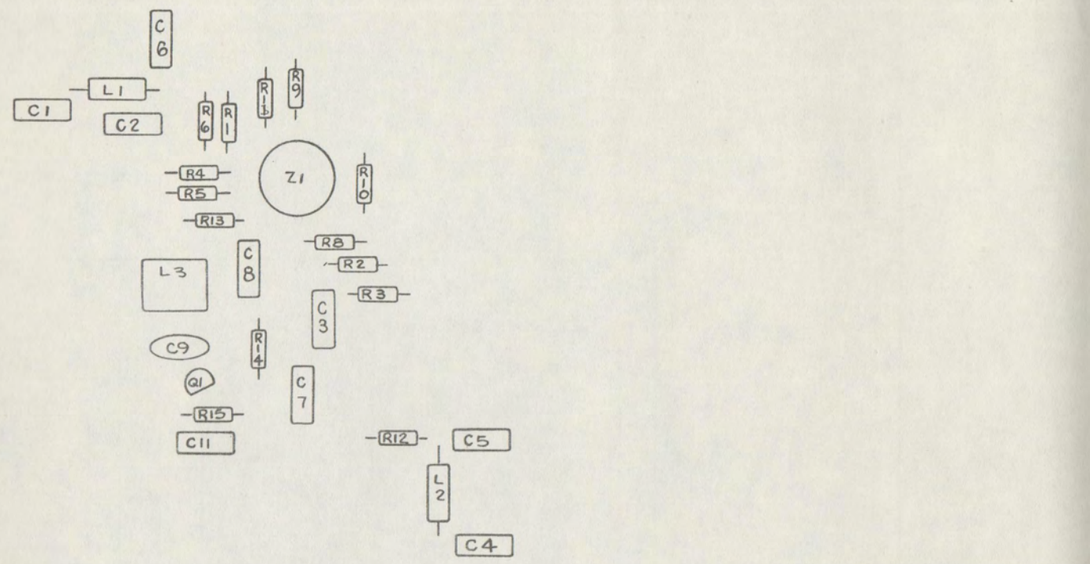
SIZE D · DRAWING NO. 6601-1080 · REV. B · SCALE — · SHT 1 OF 1

DWG. NO. 6601-1080

FIG. 6-7

CARRIER FREQUENCY OPTION, MODEL 732 6608-0671 A5

CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFG.
C1	.2µf 25V, Disc.	1005-2029	Sprague
C2	.2µf 25V, Disc.	1005-2029	Sprague
C3	.2µf, 25V, Disc.	1005-2029	Sprague
C4	.2µf, 25V, Disc.	1005-2029	Sprague
C5	.2µf, 25V, Disc.	1005-2029	Sprague
C6	.2µf, 25V, Disc.	1005-2029	Sprague
C7	.2µf, 25V, Disc.	1005-2029	Sprague
C8	.2µf, 25V, Disc.	1005-2029	Sprague
C9	Factory selected, (1500pf Typical)		Elmenco
C10	.2µf, 25V, Disc.	1005-2029	Sprague
C11	.2µf, 25V, Disc.	1005-2029	Sprague
R1	2.2K, 5%, 1/4W	1065-2201	Allen Bradley
R2	1K, 5%, 1/4W	1065-1001	Allen Bradley
R3	33K, 5%, 1/4W	1065-3302	Allen Bradley
R4	2.2K, 5%, 1/4W	1065-2201	Allen Bradley
R5	2.2K, 5%, 1/4W	1065-2201	Allen Bradley
R6	2.2K, 5%, 1/4W	1065-2201	Allen Bradley
R7	1K, 5%, 1/4W	1065-1001	Allen Bradley
R8	33K, 5%, 1/4W	1065-3302	Allen Bradley
R9	6.8K, 5%, 1/4W	1065-6801	Allen Bradley
R10	1K, 5%, 1/4W	1065-1001	Allen Bradley
R11	3.9K, 5%, 1/4W	1065-3901	Allen Bradley,
R12	330 ohms, 5%, 1/4W	1065-0330	Allen Bradley
R13	3.9K, 5%, 1/4W	1065-3901	Allen Bradley
R14	330 ohms, 5%, 1/4W	1065-0330	Allen Bradley
R15	2.7K, 5%, 1/4W	1065-2701	Allen Bradley
L1	15mh, Choke	1530-0150	Delevan
L2	15mh, Choke	1530-0150	Delevan
L3	33t of 30/44 Litz Wire on L45-1 Core, Variable z.f	1550-0033	Micrometals
Z1	µA 796 Balanced Modulator	1100-0796	Fairchild
Q1	2N 5089	1271-5089	National
	P.C. Board	1600-0670	

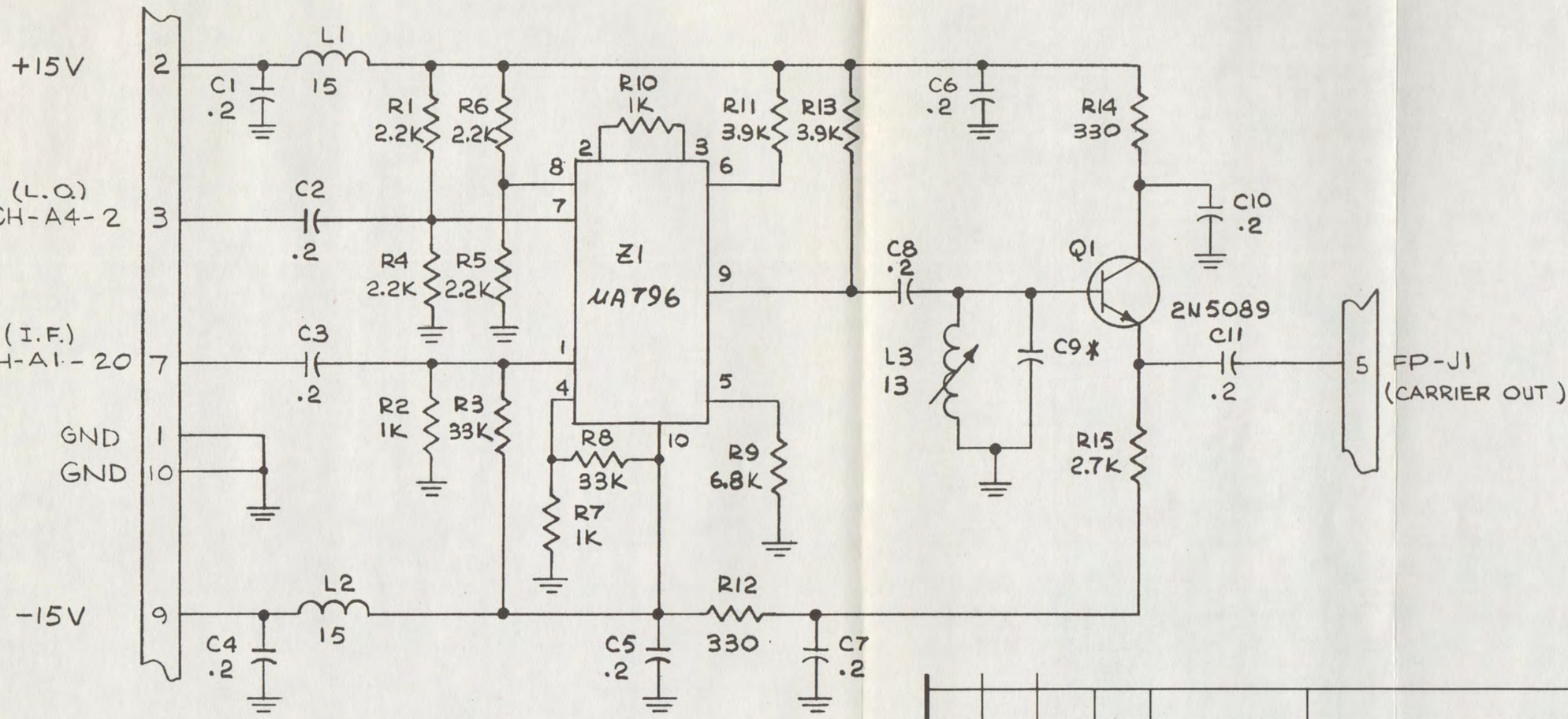


CARRIER FREQUENCY OPTION
6608-0671 A5

DWG. NO. 6601-1300

NEXT ASSY	USED ON
6608-0671	732

REVISIONS					
SYM	DESCRIPTION	DR	CHK	AUTH	DATE
B	RELEASED TO PRODUCTION	RG			1-7-73



NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.

QTY PER ASSY — LIST OF MATERIALS

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
.XX ±
.XXX ±
ANGULAR ±

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		DATE
DRAWN BY	NB	12/19
CHK. BY		
PROJ. ENG.		
MFG. ENG.		
APPD.		
APPD.		
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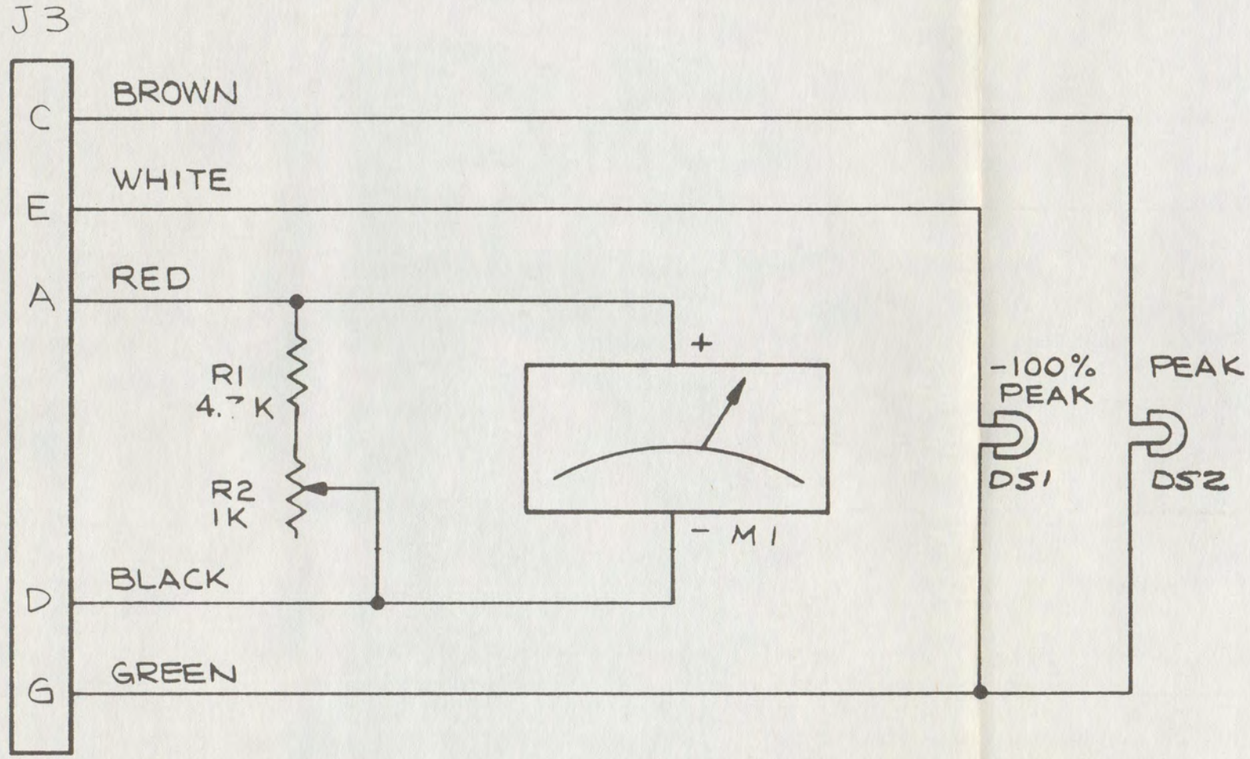
TFT TIME & FREQUENCY TECHNOLOGY INC.
3000 Olcott St., Santa Clara, California 95050
(408) 246-6365

TITLE
CARRIER FREQ OPTION (A5) FIG 6-8

SIZE	DRAWING NO.	REV.
B	6601-1300	B

SCALE ~ SHT. 1 OF 1

REVISIONS		
LTR	Description	Date



CKT. REF.	DESCRIPTION	TFT STOCK NO.	MFR.
R1	2.2K 1/4W 5% CARBON COMP RES.	1065-2201	A.B.
R2	1K 10TURN TRIMMER POTENTIOMETER	1069-1001	BECKMAN
M1	400uA FULL SCALE MODULATION METER	1400-7045	A.P.I.
P1	9 PIN PLUG	2220-0009	AMPHENOL
DS1	6 VOLT 40 MA LAMP	2300-0640	I.E.E.
DS2	6 VOLT 40 MA LAMP	2300-0640	I.E.E.

MODEL-704D

SCALE: NONE	APPROVED BY:	DRAWN BY JLC
DATE: 2 JULY 73		REVISED

REMOTE METER & PEAK FLASHERS

FIG. 6-9

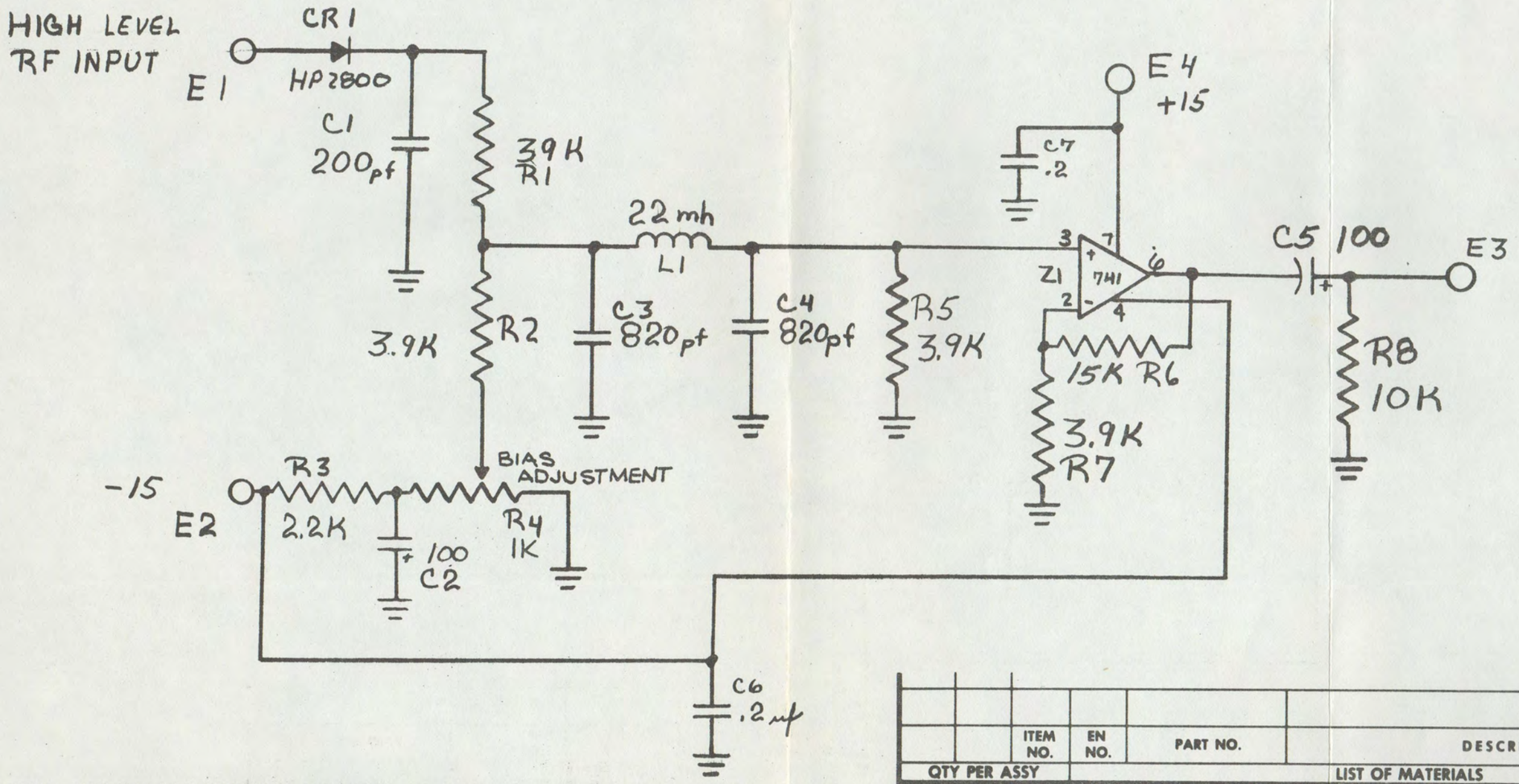
DRAWING NUMBER 6601-1140

DWG. NO. 6601-1340

NEXT ASSY	USED ON
6608-0810	713/732

REVISIONS

SYM	DESCRIPTION	DR	CHK	AUTH	DATE
A	RELEASED TO PRODUCTION	RM			



NOTES; UNLESS OTHERWISE SPECIFIED:
1. RESISTORS - VALUES IN OHMS ±5%, 1/4 WATT.
2. CAPACITORS - VALUES IN MICROFARADS.
3. INDUCTORS - VALUES IN MICROHENRYS ±10%
4. *FACTORY SELECT VALUE. TYPICAL VALUE SHOWN.
5. VOLTAGES ARE DC CONDITIONS.

ITEM NO.	EN NO.	PART NO.	DESCRIPTION	REF. DES.
QTY PER ASSY		LIST OF MATERIALS		

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
.XX ± ANGULAR ±
.XXX ±

DO NOT SCALE THIS PRINT

DRAWN BY	RAM	DATE 4-3
CHK. BY		
PROJ. ENG.		
MFG. ENG.		
APPD.		
APPD.		
ECO NO.		

TFT TIME & FREQUENCY TECHNOLOGY INC.
3000 Olcott St., Santa Clara, California 95050
(408) 246-6365

TITLE HIGH LEVEL AM BROAD BAND DETECTOR
FIG 6-14/713 & FIG 6-10/732

SIZE B | DRAWING NO. 6601-1340 | REV. A

SCALE — | SHT. 1 OF 1